A dissertation on

A STUDY TO EVALUATE THE EFFECTIVENESS OF IODINE IMPREGNATED PLASTIC ADHESIVE DRAPE DURING ABDOMINAL SURGERIES IN PREVENTING SURGICAL SITE INFECTIONS.

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This is to certify that this dissertation titled **"A STUDY TO EVALUATE THE EFFECTIVENESS OF IODINE IMPREGNATED PLASTIC ADHESIVE DRAPE DURING ABDOMINAL SURGERIES IN PREVENTING SURGICAL SITE INFECTIONS. "** is the bonafide work of **Dr.SARATH.R.S**. a postgraduate student in M.S General Surgery, Coimbatore Medical College and Hospital, Coimbatore. This study was undertaken in the Department of General Surgery, Coimbatore Medical College and Hospital, Coimbatore during the period July 2016 to June 2017 in the partial fulfilment of the requirement of the "The Tamil Nadu Dr.M.G.R. Medical University" for the award of M.S. Degree in General Surgery. This dissertation has not been submitted in part or fully to any other University or Board. It gives me great pleasure to forward this dissertation.

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The dissertation titled **"A STUDY TO EVALUATE THE EFFECTIVENESS OF IODINE IMPREGNATED PLASTIC ADHESIVE DRAPE DURING ABDOMINAL SURGERIES IN PREVENTING SURGICAL SITE INFECTIONS "** is being submitted by me to "The Tamil Nadu Dr.M.G.R. Medical University" in partial fulfilment of the regulation for the completion of the M.SGeneral Surgery Degree Examination to be held in 2018. This work has been carried out in the Department of General Surgery, Coimbatore Medical College and Hospital, Coimbatore under the guidance of Prof.Dr.S. BALASUBRAMANIAN M.S., Professor of General Surgery, Coimbatore Medical College and Hospital, Coimbatore.

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CERTIFICATE – II

This is to certify that this dissertation work titled **"A STUDY TO EVALUATE THE EFFECTIVENESS OF IODINE IMPREGNATED PLASTIC ADHESIVE DRAPE DURING ABDOMINAL SURGERIES IN PREVENTING SURGICAL SITE INFECTIONS "** of the candidate **Dr.SARATH.R.S**with registration Number **221511314**for the award of **M.S in the branch of General Surgery**, I personally verified the urkund.com website for the purpose of plagiarism Check. I found that the uploaded thesis file contains 82 pages from Introduction to Conclusion and the result shows **3% (Three)** percentage of plagiarism in the dissertation.

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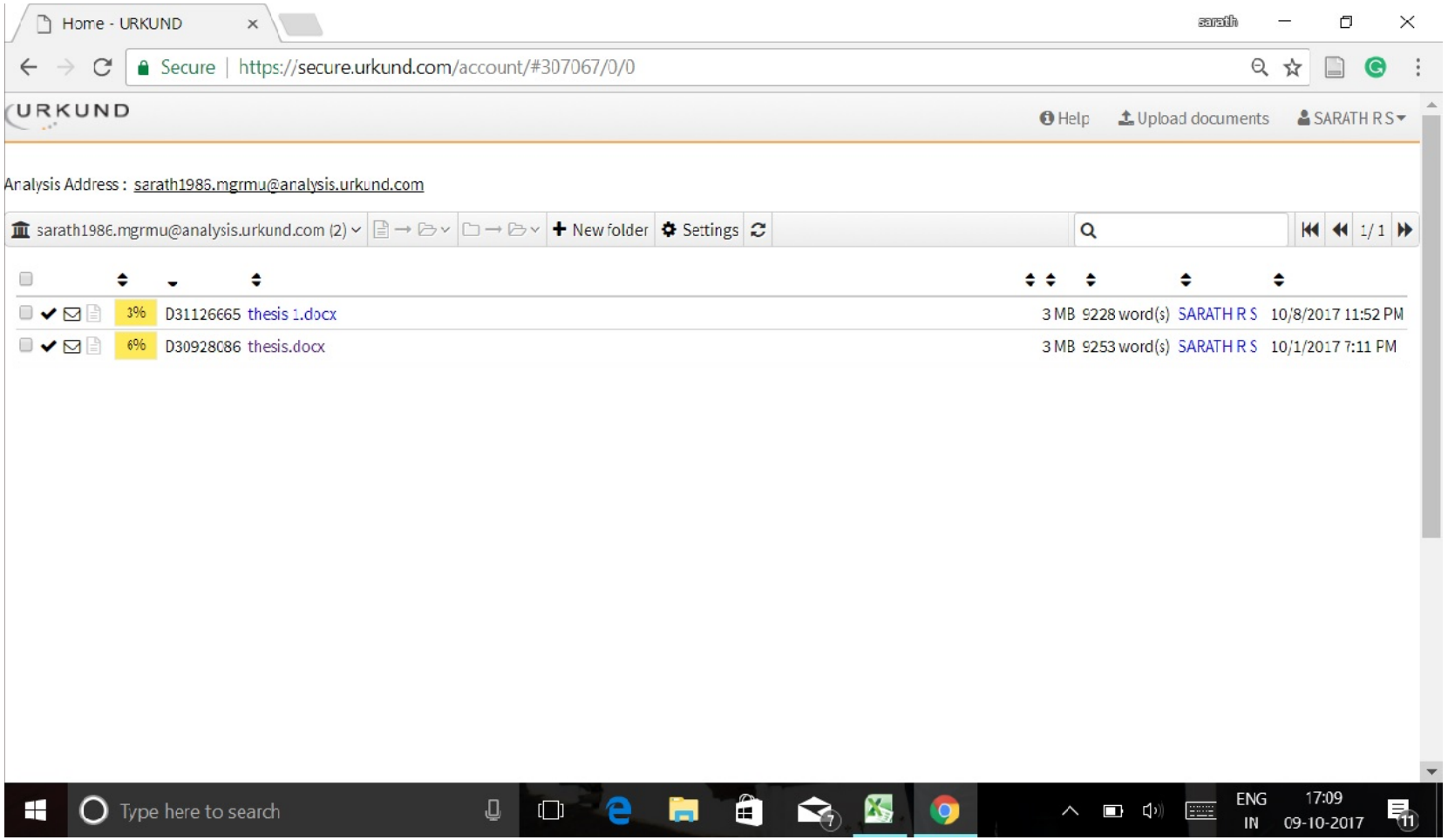
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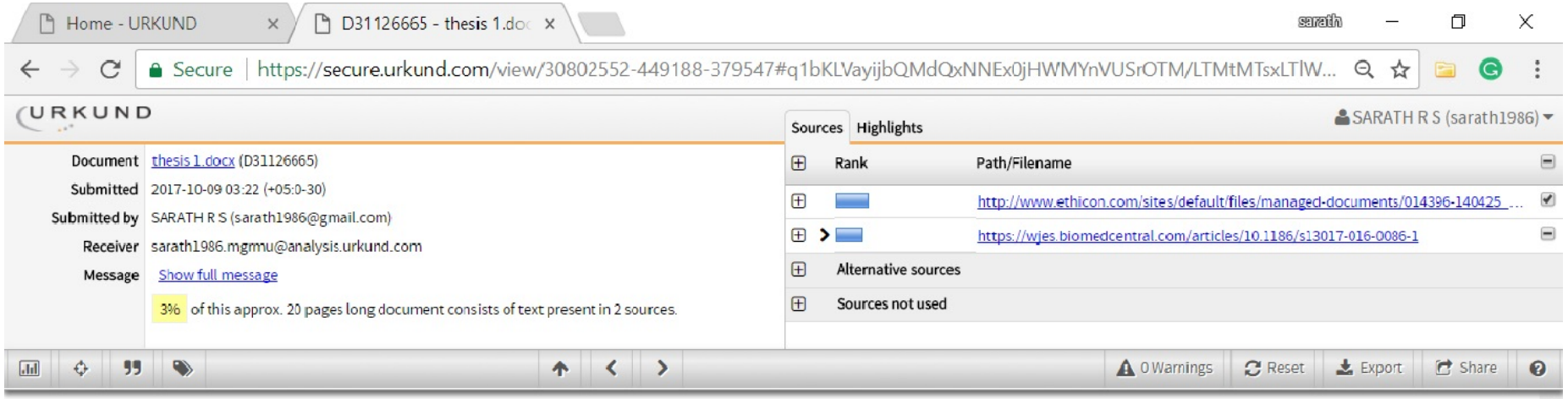

INTRODUCTION Surgical site infection is a common malady mostly due to a healthcare-associated infection. Surgical site infection is defined by the Centre for Disease Control and Prevention (CDC) 1 as a proliferation of pathogenic micro-organisms which develops in incision site either within the skin and subcutaneous tissue (superficial) or musculo fascial layers (deep) or in an organ or cavity, if opened during surgery. Surgical site infections are one of the common post-operative complications and third most common hospital-acquired infection. It can occur after 3.03% of all clean and 22.41% of all clean-contaminated surgeries. 2 However prevalence studies tend to underestimate SSI because many of these infections occur after the patient has been discharged from the hospital. SSI associated with an increase in recovery time and hospital stay, thus significantly increases the morbidity and mortality associated with surgeries. The incidence of SSI depends on many factors like the definition of infection used, the intensity of surveillance, and the prevalence of risk factors in the population studied.

Surgical site infections are the major contributor of morbidity and mortality in postoperative patients. SSI is related to, almost one-third of postoperative deaths. Gram-positive cocci, especially staphylococci, cause many of these infections. SSI can range from a relatively mild wound discharge with no other complication to a life-threatening condition. Many risk factors are associated with surgical site infections. Strategies for prevention of SSI help to reduce

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https://wjes.biomedcentral.com/articles/10.1186/s13017-016-0086-1

Instances where selected sources appear:

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ABBREAVATIONS

1. BMI Body Mass Index
2. DM Diabetes Mellitus
3. CDC Centre for Disease Control and Prevention
4. GIT Gastro Intestinal Tract
5. Hb Haemoglobin
6. NNIS National Nosocomial Infection Surveillance
7. POD Post-Operative Day
8. RBS Random Blood Sugar
9. SD Standard Deviation
10. SSI Surgical site infections
11. TC Total Leucocyte Count

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INTRODUCTION

Surgical site infection is a common malady mostly due to a healthcare-associated infection. Surgical site infection is defined by the Centre for Disease Control and Prevention (CDC)[1] as a proliferation of pathogenic micro-organisms which develops in incision site either within the skin and subcutaneous tissue (superficial) or musculo fascial layers (deep) or in an organ or cavity, if opened during surgery.

Surgical site infections are one of the common post-operative complications and third most common hospital-acquired infection. It can occur after 3.03% of all clean and 22.41% of all clean-contaminated surgeries.[2] However prevalence studies tend to underestimate SSI because many of these infections occur after the patient has been discharged from the hospital. SSI associated with an increase in recovery time and hospital stay, thus significantly increases the morbidity and mortality associated with surgeries. The incidence of SSI depends on many factors like the definition of infection used, the intensity of surveillance, and the prevalence of risk factors in the population studied.

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wound discharge with no other complication to a life-threatening condition. Many risk factors are associated with surgical site infections. Strategies for prevention of SSI help to reduce morbidity, mortality and reduce hospital and save cost for the healthcare system. Many strategies are being implemented for reducing surgical site infections.

Different techniques are in practice to prevent bacteria from entering the surgical wound. Patient's skin flora micro-organisms are responsible for most of the SSIs. The causative bacteria mostly localizes on the hair follicles[3]. Anatomy of the skin makes it difficult to maintain the skin free of micro-organisms in the perioperative period. Antiseptics only incompletely reach these areas. Bacteria harbors in the hair follicles will come up to the skin after few hours of skin preparation. Antimicrobial impregnated incision drapes help in immobilizing these bacteria and preventing the upward movement of bacteria[4–6] from these areas and thus reduces the chance for SSIs.

Even though theoretically the usefulness of antimicrobial impregnated incision drapes is arguable, several studies show conflicting results about the usefulness in preventing SSI[7]. In view of this conflicting results, in this study, we will evaluate the usefulness of iodine impregnated incision drapes in preventing SSI

AIMS AND OBJECTIVES

PRIMARY:

To compare the incidence of surgical site infection following laparotomies, with the use of iodine impregnated plastic incise drape and without iodine impregnated plastic incise drape.

SECONDARY:

1. To compare the incidence of surgical site infection among elective and emergency abdominal surgeries.
2. To evaluate the factors influencing surgical site infections.
3. To study the spectrum of micro-organisms causing surgical site infections.

REVIEW OF LITERATURE

HISTORY OF SURGICAL SITE INFECTION

Surgical site infections have always been a major complication of surgery. It has been documented even before 4000-5000 years back. The Egyptians had little knowledge about infections and they were able to prevent putrefaction, which was illustrated by mummification skills. Their medical papyruses describe the use of antiseptics to prevent surgical infections. This antiseptic method was also known to Assyrians. The Hippocratic teachings described the use of antimicrobials like vine and vinegar, which were used for cleaning of infected wounds[8]. These civilizations and later Romans believed that whenever pus localized in an infected wound, it needed to be drained.

A roman physician, Galan identified that the localization of infection in wounds, inflected in the gladiatorial arena, often heralded recovery, particularly after drainage[9]. Sadly this was misunderstood by many physicians later on, who thought that production of pus was desirable. Until well into the middle ages, some physicians promoted suppuration of wounds by application of some toxic substances, in the false belief that healing could not occur without pus formation. Theodoric of Cervia, Ambroise Pare and Gy de Chauliac observed that clean wound closed primarily could heal without infection or suppuration.

The causes of wound infection were studied in detail in the 19th century. Microbes were identified after the invention of the microscope by Anton van Leeuwenhoek. Koch put forward the first definition of infective disease in Koch's postulate.

Koch's postulates were stated in 1882 [10]

- Infective organisms must be found in considerable number in the septic focus.
- It should be possible to culture these organisms, in their pure form of the septic focus
- These organisms from pure culture must be able to produce similar lesions when injected into a healthy host
- The organism should be able to reisolate from the new host

Ignaz Semmelweiss, an Austrian obstetrician showed that puerperal sepsis could be reduced considerably by hand washing between cases, which was not a routine practice in that days.[11]

Louis Pasteur, who was a French chemist and microbiologist found out that microorganisms cause fermentation and disease.[12] He developed the technique of pasteurization and vaccination against rabies and anthrax

Joseph Lister, who was a surgeon applied this knowledge for the reduction of colonization organisms in wounds by using techniques of antisepsis [13]. This helped to do surgeries with reduced infection rates. However, his toxic phenol spray and antiseptic surgery give way for

aseptic surgery by next century. Instead of destroying the microorganisms in the tissues (antiseptic surgery), the condition in which surgeries were conducted were kept free of bacteria[14].

The discovery of sulphonamide chemotherapy made the concept of a magic bullet that could kill microbes, into reality[15].

Alexander Fleming, discovered Penicillin in 1928, which helped save millions of lives. Fleming together with Florey and Chain discovered the methods of large-scale production of Penicillin[16]. A police constable named Alexander was the first person to receive Penicillin, who was suffering from a staphylococcal bacteremia. He responded to treatment and made a partial recovery but later on, he died of relapse. Since then, the era of broad-spectrum antibiotics started. The days of certain death following fecal peritonitis are now past but challenges still remain.

With the introduction of newer antibiotics for treatment and prophylaxis, and with the advancement of anesthesia and better post-operative management facilities, surgeries which were not considered as possible in past became possible now.

DEFINITION AND CLASSIFICATION

Surgical site infections were previously called as wound infections. Centers for Disease Control and Prevention (CDC) and surgical and medical societies jointly developed the concept of SSI, which includes any infection that occurs at an operative site. It can be superficial or deep SSI or associated with organ/space[1,17].

An infection involving the subcutaneous tissue only is termed a superficial SSI. Infection involves the muscular and fascial layers are termed as deep SSI. Infection that occurs inside the organ or deep space of the wound like peritonitis, an intra-abdominal abscess, or a joint space infection is termed as an organ/space SSI.

According to Data from the National Nosocomial Infection Surveillance (NNIS) system of the CDC shows of all SSIs, 47% are superficial, 23% are deep, and 30% are organ/space. Out of this only, 46% of these SSIs are diagnosed during the original hospitalization, 16% are diagnosed after discharge as outpatients and 38% are diagnosed on readmission to the hospital[18,19].

SUPERFICIAL SSI.

Defined as an infection occurring within first 30 days of the surgery. Infection involving only the skin and subcutaneous tissues and one of the following criteria should be met:

- Pus discharge with or without confirmation by laboratory.
- Wound culture done shows presence of bacteria.
- Signs of inflammation such as pain, redness, local rise in temperature.
- Attending surgeon identifies superficial SSI.

DEEP SSI.

Defined as an infection occurring within 30 days after the surgery if no implant used or within 1 year if the implant is used. The infection involving the deep soft tissues, like deep facial layers and at least one of the following criteria, should be met:

- Discharge of pus from deep incision but not from organ/space.
- When the patient is having one of the following signs or symptoms of fever , inflammation, a deep incision is being opened by a surgeon or spontaneously opened.

- During examination an abscess involving the deep incision found directly.
- Attending surgeon identifies deep SSI.

ORGAN/SPACE SSI.

Defined as an infection that occurs within 30 days of operation if implant is not used or within 1 year if implant is used and the infection may appear to be related to the surgery and that involves any part of organs/ space, other than the incision, and any of the following criteria should be present:

- Discharging pus from a drain from organ/space.
- Culture from the fluid collected from the organ or space showing growth of organisms.
- On direct examination, abscess found related to organ/ space.
- Attending surgeon identifies organ/space SSI.

Figure 1- SUPERFICIAL SSI

Figure 2 - DEEP SSI

The classification of organ/space SSI in surgical practice(excluding gynecology) proposed by the Scottish Intercollegiate Guidelines Network (SIGN)[20]

SITE/ORGAN-SPECIFIC SSI

Arterial/venous infection
Breast abscess and mastitis
Disc space
Ear, mastoid
Endocarditis
Eye other than conjunctivitis
Gastrointestinal tract
Intra-abdominal
Intra cranial, brain abscess
Meningitis, ventriculitis
Myocarditis or pericarditis
Oral cavity
Osteomyelitis
Spinal abscess
Sinusitis

Table 1 - SITE/ORGAN SPECIFIC SSI

Figure 3 - POD3 WOUND WITH NO SSI

Figure 4 - POD 3 WOUND WITH SSI

Figure 5 - POD 10 WITH NO SSI

Figure 6 - POD 10 WITH SSI

MICROBIOLOGY OF SURGICAL SITE INFECTIONS

The most common organisms causing SSI are from patient's endogenous flora. Data from the NNIS system shows that the distribution of pathogens isolated from SSIs has not changed considerably in the past decade. E- coli, Staph aureus, Enterococcus spp., and are the common organisms[21] causing SSI.

Bacterial isolate

Gram-positive

- S. aureus
- Coagulase-negative staphylococci
- Group B streptococci spp.

Gram-negative

- E. coli
- Acinetobacter spp.
- K. pneumonia
- K. ozaenae
- P. aeruginosa
- P. vulgaris
- P. mirabilis
- Morganella spp.
- Citrobacter spp.

MICRO-ORGANISMS ASSOCIATED WITH DIFFERENT SURGICAL PROCEDURES[22]

ORGANISM ASSOCIATED	TYPE OF SURGERY
Staph. aureus **Coagulase-negative staphylococci**	Graft Prosthesis
Staph. aureus **Coagulase negative staphylococci**	Cardiac surgery
Staph. aureus **Coagulase negative staphylococci**	Neurosurgery
Staph. aureus **Coagulase-negative staphylococci**	Breast
Staph. aureus **Coagulase-negative staphylococci** **Gram-negative bacilli**	Ophthalmic
Staph. aureus **Coagulase negative staphylococci** **Gram negative bacilli**	Orthopaedic
Staph. aureus **Coagulase negative staphylococci** **Gram negative bacilli** **Streptococcus pneumoniae**	Non- cardiothoracic
Staph.l aureus **Coagulase negative staphylococci**	Vascular
Gram negative bacilli, anaerobes	Appendicectomy
Gram negative bacilli **Anaerobes**	Biliary tract

Gram negative bacilli **Anaerobes**	Colorectal
Gram negative bacilli **Streptococci**	Gastroduodenal
Anaerobes	Oropharyngeal
Staphylococcus aureus **Streptococci**	Head and neck
Gram negative bacilli **Enterococci** **Group B streptococci**	Obstetrics and gynaecology
Gram negative bacilli	Urological

Table 2 MICROORGANISMS ASSOCIATED WITH SURGICAL PROCEDURES

Risk of developing SSI after surgical site contamination by micro-organisms is directly proportional to the virulence of the pathogen and dose of bacterial contamination and it is inversely proportional to the resistance of the patient[23]. When the level of contamination is above 10^5 organisms per tissue, the risk of developing surgical site infection is high. If any foreign materials such as sutures present SSI can develop with lower dose of bacterial contamination[21]

FACTORS INFLUENCING WOUND HEALING

Factors influencing wound healing may be considered as local factors and systemic factors which have influence on wound healing

LOCAL FACTORS:

1.Infection

2. Blood supply

3. Surgical technique

4. Mechanical stress

5. Suture materials

6. Suture technique

7. Radiation

INFECTION:

Most important local factor that impairs healing is a bacterial infection of the wound. The usual infections caused by wounds closed by primary suture are just a source of morbidity whereas infections in orthopedic, plastic surgery are known for their grave consequences.

BLOOD SUPPLY:

The prime factor that results in a good healing is blood supply as it is essential for oxygen supply and nutrients as well as removal of metabolites.

Factors that cause tension on the wound may impair its blood supply which may be external tension or intrinsic build-up of pressure. Swelling of the wound as a result of inflammation during the first few days is a natural phenomenon. Hence surgeon should consider and allow for such changes.

SURGICAL TECHNIQUE:

Good surgical technique implies gentle tissue handling, achieving hemostasis, obliteration of dead space in the wound, avoiding tissue necrosis that occurs due to excessive cauterization or strangulation of tissue by ligatures.

The advantage of diathermy over conventional suture ligation in wound hemostasis is still under debate. Diathermy should be used sparingly and ligatures, when applied, should not strangulate surrounding tissues.

Whenever dead space exists hematoma occurs. Dead space usually occurs in surgeries in which tissue flaps are raised and in obese individuals. Obliteration of dead space can be done by placing drains, external pressure and in obese individuals by suture obliteration of subcutaneous layer.

MECHANICAL STRESS

Extrinsic wound tension may cause the sutures to give away causing gaping.

SUTURE MATERIALS

Features of ideal suture material:

- Adequate tensile strength
- Good knot holding property
- Should have less memory
- Should be less reactive
- Easy handling property
- Cost-effective
- Easily available

SUTURE TECHNIQUE

Suture techniques influencing wound healing are considered in two categories. They are general aspects and technical aspects. General aspects include the careful apposition of wound edges, avoidance of strangulation of tissues, proper selection of suture materials and secure knotting of sutures.

Sutures should be lateralized as they may cut out if they are close to the wound edges because after several days after closure the edges become weakened due to the breakdown of collagen.

A few examples of technical aspects are using surgeons knot in preference to a granny knot. Monofilament nylon and proline have poor knotting capacity and at least five throws should be used to prevent knot slipping when they are used.

RADIATION

Impairment of wound healing due to radiation usually occurs in the management of skin wounds in previously irradiated tissues.

SYSTEMIC FACTORS

1. Age
2. Malnutrition
3. Vitamin deficiency
4. Zinc deficiency
5. Drugs-cytotoxic and antimetabolites, steroids
6. Anemia
7. Uremia
8. Jaundice
9. Trauma
10. Malignancy

AGE

Impaired wound healing is prevalent among elderly. numerous other factors like malnutrition and various other systemic abnormalities coexist hence age alone cannot be taken as a factor affecting wound healing

MALNUTRITION:

Malnutrition implies deprivement of calories and proteins. Existing collagen in the tissues cannot be utilized in the repair of wounds. But

there is evidence stating that amino acids of the collagen are reutilized in healing and repair.

Amino acid Methionine has a prime role in wound healing. Methionine and cystine are necessary for the proliferation of fibroblasts. In malnourished individuals, methionine deficiency results in failure of collagen and mucopolysaccharide synthesis and thereby impairing wound healing.

VITAMIN DEFICIENCY

Vitamin C(ascorbic acid) is the most important among the vitamins influencing repair of wounds. Ascorbic acid is essential for cross-linking of collagen thereby increasing the tensile strength of the wound. Surgical trauma causes a fall in ascorbic acid levels. The lowest levels of leucocyte fall of ascorbic acid are seen among the elderly.

Vitamin A causes stabilization of lysosomal membrane and it is thought Vitamin A reverses the inhibitory effects of corticosteroid on the wound.

Vitamin E has impaired wound repair in experimental animals but there is no evidence among human beings.

Vitamin D is essential for calcium metabolism.IN rickets, vitamin D deficiency interferes with bone metabolism resulting in a soft collagenous matrix instead of calcified bone.

ZINC DEFICIENCY

Zinc deficiency has its own consequences on wound healing. Zinc is necessary for several enzymatic reactions in our body. It is a lysosomal and cell membrane stabilizer by inhibiting lipid peroxidizes. DNA polymerase, lysyl oxidase, and reverse transcriptase. It also affects cell proliferation, collagen production etc, Only in certain conditions such as intestinal fistulas and severe burns there occurs significant zinc deficiency to cause impaired wound healing. Patients on prolonged parenteral nutrition in the absence of enteral feeding require zinc supplementation.

TRAUMA

Several clinical studies have proven that trauma, hypervolemia, and hypoxia impair wound healing. There exists a direct relationship between the severity of wound infection to the severity of trauma and there is a correlation between the amount of blood loss and incidence of abdominal wound dehiscence and anastomotic wound dehiscence.

Studies show that remote trauma and the resultant hypovolemia increased the susceptibility to infection mainly staphylococcal and pseudomonas infection among animals.

The final cause for impaired healing in trauma and hypovolemia is tissue hypoxia. Because oxygen is essential during collagen synthesis as it is an essential factor for hydroxylation of proline and lysine.

But there is no observation to improve that tissue hypoxia is the final factor responsible for impaired healing, there may be other factors involved.

Since low oxygen tension impairs wound healing, healing can be improved by increasing the oxygen supply to the wound. For example, in tissue cultures fibroblast proliferate at an optimum tension of 60mmhg, but silver found that they proliferate in-vivo at a tension of 15mmhg.This led to the concept of super normal wound healing, according to which improved wound repair occurs by increasing the oxygen tension which in turn increases the collagen synthesis.

All these observations are based on simulated wounds in tissue chambers and it should be remembered that these differ from surgical wounds.

DRUGS

Recent increase in transplantation surgeries and oncological advances has led to use of cytotoxic drugs and antimetabolites.

Steroids impair healing by its stabilization effect on cell membranes. Experimental studies show that the effect of steroids can be reversed by administration of Vitamin A.

Studies also exist stating that steroids impair healing only when it is used before surgery or during the early postoperative days. There is little or no effect when used several days after surgery.

Sepsis and wound gaping are in general more common among those patient receiving steroids during the course of treatment. But these adverse effects cannot be only due to the effect of steroids on those patient receiving steroids usually have a serious illness, malnutrition and other co-existing factors that impair healing.

ANAEMIA

Anaemia by definition implies reduced oxygen carrying capacity of blood. Hypoxia is associated with wound complications such as dehiscence.

MALIGNANCY

Malignancy per se an independent factor impairing healing is uncertain. Certain studies state that there are two-fold increases in wound complications in individuals suffering from malignancy.

Jaundice occurring due to malignant common bile duct obstruction is associated with a higher incidence of abdominal wound dehiscence.

JAUNDICE:

There is no clear-cut evidence to state jaundice as systemic factor impairing wound healing.

A retrospective study was done using 48 jaundiced patients undergoing abdominal surgery. Wound healing in these patients was compared with findings in 281 anicteric patients. 46 of the 48 jaundiced patients extra hepatic biliary obstruction; an incisional hernia occurred in 27%. The findings suggest that jaundice affects wound healing. But the clinical significance remains uncertain.

THE EFFECT OF BACTERIAL INFECTION ON WOUND HEALING:

The biochemistry of wound infection is complex. Histological features of wound infection are delayed epithelial growth and migration, cellular necrosis, micro vascular thrombosis.

The above-mentioned changes are due to the effect of both bacterial toxins and change in the chemical environment of the wound.

The basic biochemical abnormality is an alteration in collagen synthesis. There occurs exaggerated lysis of wound collagen by collagenolytic enzymes.

The second factor that alters collagen metabolism is a disturbance in the synthesis of collagen. Fibroblast involved in collagen synthesis are deprived of nutrition in the presence of infection as these nutrients are consumed by the inflammatory cells and bacteria.

As a consequence of above-mentioned changes, collagen synthesis is reduced and the process also extends into unwounded tissues causing the edges to become weak mechanically and sutures eventually cut out resulting in wound dehiscence.

CLASSIFICATION OF WOUND

Wounds are divided as clean, clean-contaminated, contaminated and dirty according to the possibility of wound contamination during surgery. This classification helps to divide wounds into different risks for development of SSI.

Class	Definition
Clean wound	An uninfected wound in which no inflammation is encountered and the respiratory, alimentary, genital, or infected urinary tract is not entered.
Clean- Contaminated	An operative wound in which the respiratory, alimentary, genital, or urinary tracts are entered under controlled conditions and without unusual contamination
Contaminated	Open, fresh, accidental wounds. Operations with major breaks in sterile technique or gastrointestinal tract spillage
Dirty	Old traumatic wounds with retained devitalized tissue and those that involve existing clinical infection or perforated viscera

Table 3 CLASSIFICATION OF WOUND

SURGICAL WOUND TYPES

According to American College Of Surgeons four classes of surgical wound present.

CLASS OF WOUND	DEFINITION	EXAMPLES	INCIDENCE OF SSI
CLEAN	Surgeries no involving GIT, genitourinary, respiratory tracts	Thyroidectomy	1 %
Clean-Contaminated	Surgeries that involve GIT, genitourinary, respiratory tracts with minimal spillage	Gastrectomy	5 %
Contaminated	Significant spillage during surgeries of GIT	Bowel perforation	>20 %

Table 4 type of surgery

Recommendations For The Hospital Infection Control Practices Advisory Committee For The Prevention Of SSI[24]

Patient-related

- Avoid patients with active infections
- Avoid shaving in advance
- Good glycemic control
- Stop tobacco usage
- Cleaning with antiseptic solution
- Use of plastic adhesive incise drapes

- Surgeon-related
  - Cut the nails short
  - Hand scrubbing
  - Wear mask
  - Cover all hair
  - Non-infected surgeon
  - Sterile gloves
  - Use aprons that resist fluid penetration

- Surgery-related
  - Avoid flash sterilization
  - Operating room should be closed
  - Instruments should be sterile
  - Prophylactic antibiotics

PREVENTION OF SSI

Preventing SSI is a major aim for any operating surgeon. Many strategies are adapted in order to reduce SSI. Several factors in the immediate perioperative period of surgical patients have been demonstrated to have a significant effect on the development of SSI. Technical conduct of the operation, including the handling of tissues, number of ties and other foreign material and devitalized tissue, and length of the operation, all influence the risk of SSI.

Surgeons think about prophylactic antibiotics for prevention of SSI, and prophylactic antibiotic is indeed important, antibiotics are combined with other methods for prevention of SSI

Several factors in the immediate perioperative management of surgical patients have been shown to have a significant effect on the risk for SSI. In spite of these factors, most surgeons believe that the technical conduct of the operation, including the handling of tissues, number of ties and other foreign material and devitalized tissue, and length of operation, all influence the risk of SSI. But there are no valid methods asses the influence of these factors on SSI.

FACTORS INFLUENCING SSI

INSPIRED OXYGEN TENSION

Multiple studies show that oxygen tension within the surgical wound influence the risk for SSI[25]. Higher oxygen tension decreases the risk, whereas lower tension increases the risk.[26,27]

TEMPERATURE CONTROL

The temperature of a patient inside the operation theatre is having a direct influence on skin and subcutaneous blood flow and oxygen tension[28]. Animal models have demonstrated that when body temperature is lowered chances of wound infection increases[29]. Few recent studies show that there is a significant reduction in SSI in patients who were actively warmed[30].

GLYCEMIC CONTROL

Diabetic patients are having a higher risk for SSI than non-diabetic patients. It has been assumed that it is directly related to defect in the host defect mechanisms[31]. All hyperglycaemic surgical patients will benefit from perioperative glucose control[32].

ANTIBIOTIC PROPHYLAXIS

Prophylactic antibiotic for surgical procedures started after the initial introduction of penicillin with the hope that antibiotics would reduce the risk of surgical wound infections. Many studies show that preoperative antibiotic (prophylactic) helps in decreasing SSI

considerably[33]. Prophylactic antibiotic is indicated for all GI cases and also for obstetric, gynaecologic, oropharyngeal, vascular (abdominal and leg), and open heart procedures[34].

The use of prophylactic antibiotic in clean cases remains controversial. But, prophylactic antibiotic treatment is used routinely for clean procedures such as open-heart operations, joint replacement, vascular prostheses, and craniotomy, in which the consequences of SSI are especially severe. Antibiotic dosage has to be maintained in such a way that, antibiotic tissue concentration should be maintained throughout the procedure[35,36].

Antibiotic should be active against relevant pathogen.

SURGERY	**ANTIBIOTIC PROPHYLAXIS**
Cardiothoracic surgery	Cefazolin Cefuroxime Vancomycin Clindamycin
Vascular surgery Hip arthroplasty	Cefazolin Cefuroxime Vancomycin Clindamycin

Colon surgery	Cefoxitin Cefotetan Ampicillin-sulbactum Cefazolin and metronidazole Clindamycin plus aminoglicoside Metronidazole plus aminoglicoside
Vaginal or abdominal hysterectomy	Cefazolin Cefotetan Cefoxitin Cefuroxime Ampicillin-sulbactum Clindamycin plus aminoglicoside Metronidazole plus aminoglicoside

Table 5antibiotic prophylaxis in different surgeries

SHAVING

Even though there is no clear-cut evidence that removing hair at the operative site has a role in reducing SSI, shaving has been routinely practiced everywhere. In contrast, studies show that avoiding hair removal or using trimmers rather than shaving decreases the incidence of SSI[37]. If the hair removal is necessary, it should be done with hair clippers and during the immediate pre-operative period.

DELAYED PRIMARY CLOSURE

A classic method is to leave infected wound open and then do delayed primary closure a few days later or leave the wound as such so that it closes by secondary intention

DIAGNOSIS OF SURGICAL SITE INFECTION

SSI can be easily diagnosed when the wound opens and discharges pus. Most SSIs are not clinically evident before the fourth or fifth postoperative day. One exception is an infection caused by beta-hemolytic streptococci. If the patient develops any systemic signs of infection within the first few days of surgery, incision site should be checked for signs of SSI.

Usually, most wound infections are diagnosed within first 2 weeks of surgery, the very late presentation also may occur. Many patients might have first few days of surgery. But fever is not a specific sign for wound infection. In most of the times, SSI cannot be treated without reopening the incision.

MANAGING POTENTIAL SURGICAL SITE INFECTIONS[38]

The most important treatment of SSI is to open the incision and remove all the infected materials. If there is a significant systemic response to infection or there is a significant infection at the operative site, antibiotic can be used. When an incision is first opened, it should be opened by a surgeon who knows the procedure and underlying anatomy.

Because in some cases incisional SSI may not be the primary cause. Empirical antibiotic therapy should be started as soon as suspecting a wound infection. The opening of the wound only if there is significant systemic reaction with a temperature above 38_C, an elevated pulse rate, or an absolute WBC count above 12,000/mm3 or if there is an invasive infection in the subcutaneous space or at the fascial level.

The increased additional expense associated with SSIs leads to the introduction of strategies that might reduce the incidence of SSI, like the use of sterile disposable materials[39,40]. One of the methods used to reduce SSI is the use of plastic adhesive drapes[41]. Plastic incise drape was first introduced about 40 years back[42].

This strategy was first used in a cohort of patients undergoing abdominal surgeries. The aims of the study were to test adherence of a polyvinyl drape to the skin[41], to assess the level of wound contamination; and to assess skin and wound reaction to the drape.

Sterile surgical drapes are used to prevent contact with unprepared areas during surgeries and also for maintaining sterility from environmental surfaces. Surgical gowns and drapes are made from single use or multiple use materials. During surgeries, if the barrier materials become wet, the risk of microbial transmission increases. Drape or gown materials should prevent penetration of liquids[43].

Adhesive plastic incise drapes, pain or iodine impregnated are used on the patient’s skin after completion of routine skin preparation. The incise drape film adheres to the patient's skin and the surgeon makes an incision in the skin through the drape.

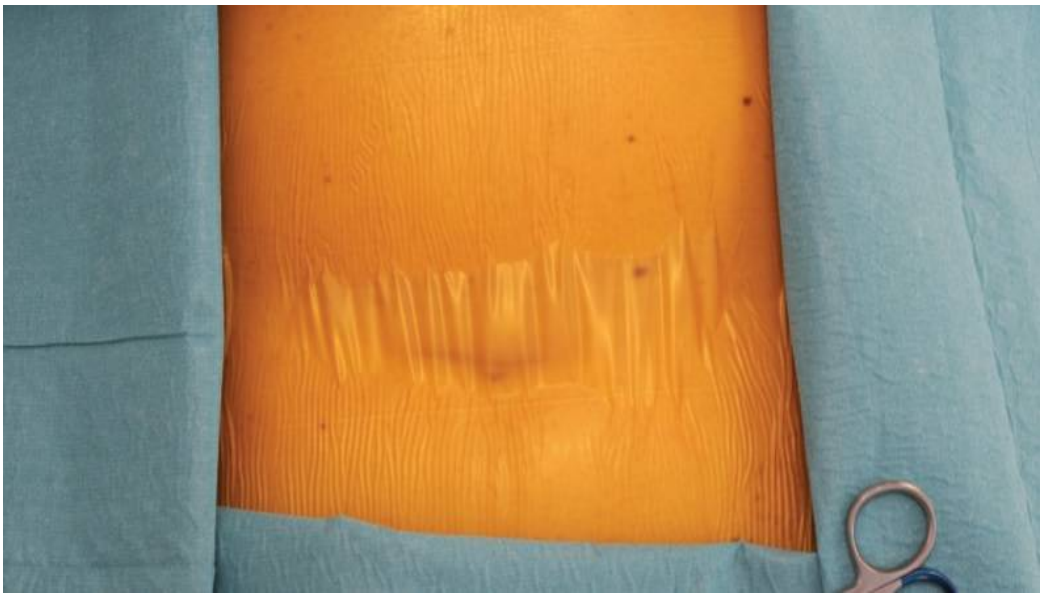

Figure 7 - INCISE DRAPE

These drapes theoretically supposed to create a mechanical barrier for preventing migration of microorganisms from the skin surface to the surgical site. Some reports show that there is a chance of recolonization of microorganisms underneath the drape compared to no drape.

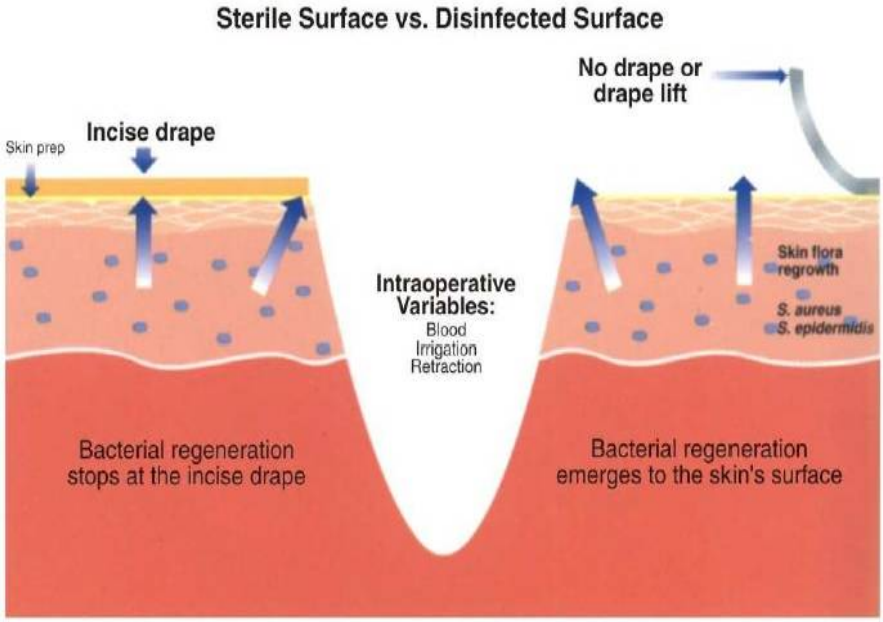

Figure 8 - MECHANISM OF INCISE DRAPE

PLASTIC ADHESIVE INCISE DRAPE – HOW ITS APPLIED

These incise adhesive drapes are composed of a polyethylene film coated with an iodophor-containing, pressure sensitive adhesive.

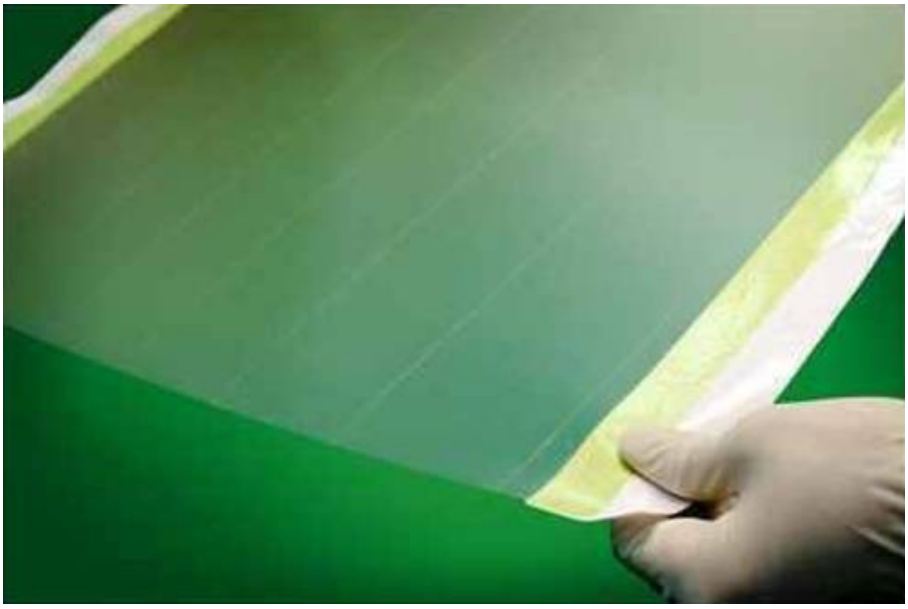

Figure 10 - IODINE IMPREGNATED PLASTIC ADHESIVE INCISE DRAPE

The patient is prepared with routine skin preparation using povidone-iodine followed by the surgical spirit. Cloth side drapes are applied as usual. The skin should be completely dry before applying the drape for achieving a good adherence of drape to the skin surface without the edges lifting during the operative procedure. The plastic adhesive incise drapes are then applied. The incision is made through the drape and surgery is carried out. Before skin suturing drapes are removed from the edges, about 3 cm from wound edges, so that skin suturing can be completed. Before removing the drape, incision area is covered with a sterile dressing.

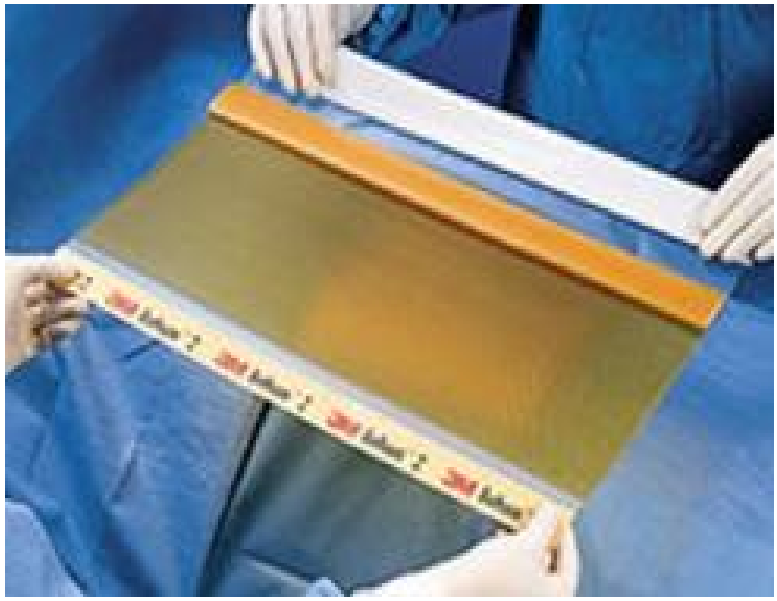

Figure 10 - INCISE DRAPE - HOW IT IS APPLIED

SCOPE OF THE STUDY

Even though theoretically the use of plastic adhesive incise drapes are arguable, reports have been published regarding their usefulness in limiting bacteria around the surgical site and for preventing SSI are conflicting[7]. Bacteria tend to recolonize after skin preparation using routine methods as surgery progress[44,45]. The rate of recolonization is found to be higher with the use of plastic adhesive drapes[46]. Moreover, allergic reactions to povidone-iodine are not unknown, and there is at least one case report of allergic contact dermatitis associated with the use of iodophor-impregnated incise drapes. In a related systematic review, found no benefit in using iodophor-impregnated adhesive drapes to prevent postoperative surgical wound infection, when they were used as part of preoperative skin antisepsis[47].

In light of these controversies, and because their use is widespread, a systematic review of the possible usefulness of adhesive drapes is justified to guide clinical practice.

MATERIALS AND METHODOLOGY

The study population included were patients above 18 years of age who were posted for emergency and elective laparotomies. Clean-contaminated and contaminated surgeries were only included in our study. After giving a written informed consent, patients who were willing to participate in the study were studied over a period of one year between July 2016 and June 2017

STUDY DESIGN

This is a prospective cohort study.

PLACE OF STUDY

The study was conducted in the Department of General Surgery, Govt. Coimbatore Medical College Hospital, Coimbatore, after obtaining permission from Heads of the concerned departments.

SAMPLE SIZE CALCULATION

Estimation of sample size with the difference between proportions.

According to a previous study [48] P1= 15 % P2= 1.6 %

$$N = \frac{2 \times P \times Q \times [(Z\text{-}\alpha/2) + (z\text{-}\beta)]^2}{(P_1 - P_2)^2}$$

Where

N = sample size

(Z – α) is α error and

(Z – β) is β error

(Z – α/2) = 1.96 (at 95 %)

(Z – β) = 0.84 (at 80%)

N = 66.46

Based on above calculation, by round it off to next 10, sample size required for this study was around 70 cases. Out of this 70 selected cases, 8 patient was lost in follow-up and sample size (N) was recalculated as **62**

INCLUSION CRITERIA

Patients above 18 years of age, planned for emergency and elective laparotomy (clean-contaminated and contaminated surgeries), who were willing to participate in the study after giving written informed consent.

Exclusion criteria

- Morbidly obese patients
- Patients who have known allergy to providone iodine
- Patients unwilling to undergo the study.

ETHICAL CLEARANCE

The study was conducted after getting prior permission from the Department of General Surgery and the study proposal was approved by the ethics committee meeting conducted at Govt. Medical College, Coimbatore.

At the time of admission, patients were identified and informed consent was obtained. Patients were assigned to two groups.

Group 1 had the standard 5 minutes povidone iodine skin preparation, followed by surgical spirit followed by application of iodine impregnated incise drape.

Group 2 had standard 5 minutes provide iodine skin preparation, followed by the surgical spirit.

Immediately prior to operation, each patient will be randomly allocated either to receive the drape(group 1) or not to receive the drape (group 2). Randomization was achieved by sequential selection from a random number table.

Pre-operative shaving was done using shaving razor on the day of operation. Mupirocin ointment was applied to the nares of the patient prior to the surgery and a dose of prophylactic antibiotic was given prior

to the surgery. An extra antibiotic dose was given in case the surgery was extended beyond 4 hours.

The drape used was iodine impregnated incise drape of 60×60 cm size. Patient's skin was prepared with routine skin preparation using povidone iodine and surgical spirit. Cloth side drapes were applied as usual and the skin has to become dry. Using two people the liner over the drape was removed, the incise drape was held over the proposed incision site with adequate tension. The drape was smoothened down, first along the intended incision line and then over the remaining areas.

Figure 11 - INCISE DRAPE APPLIED AFTER STANDARD SKIN PREPARATION AND CLOTH SIDE DRAPES

The incision was made over the drape and surgery was proceeded. At the end of the procedure, before skin closure, the crease was created in the drape and drape separate drape from the skin surface and about 3 cm space created in the skin edge for skin suturing. After completion of skin

closure, cover the suture site with sterile dressing and drapes were removed.

Figure 7 INCISION MADE OVER THE DRAPE

Patients were assessed pre-operatively, intra as well as post-operatively. Each patient was followed up from the time of admission and post-operatively at days 3, 5, 7 and weekly for 4 weeks (total 30 days).The surgical site was examined with regards to tenderness, purulent discharge, wound gaping, raised local temperature, local tenderness.

Wound infection was diagnosed only if following criteria were fulfilled.

- Signs and symptoms of inflammation like rubor, calor , dolor, and edema around the wound covering the area.
- Purulent discharge from the wound site
- Fever > 38.5 degree Celsius on two consecutive occasions with a gap of fewer than 24 hours.

Stich abscess and seroma were excluded as they do not fulfill the criteria for diagnosing SSIs.

Wounds with purulent discharge were opened and swabs were taken under all aseptic precautions and sent for culture and sensitivity.

The following data were analyzed from all the subjects included in the study

- Age
- Sex
- Diabetes
- Obesity
- Smoking history
- Alcohol consumption
- Type of procedure
    - Emergency
    - Elective
- Complete blood count
- Blood sugar
- Renal function test
- Liver function test
- Day of identification of SSI

- Duration of hospital stay
- Signs of wound infection
  - Redness
  - Pain
  - Tenderness
  - Swelling
- Duration of surgery
- Microbiological spectrum

STATISTICAL ANALYSIS

Descriptive analysis was performed. Categorical variables were reported as frequencies or relative frequencies and compared using the X^2 or Fisher exact test as appropriate. Continuous variables were reported as means with standard deviations and medians with minimum and maximum values and compared using the Student t-test or the Mann-Whitney U test if not distributed normally.

Null hypothesis: There is no significant difference in incidence of SSI between two groups

Alternate hypothesis: There is a statistically significant difference in incidence of SSI between two groups.

P <0.05 is taken as significant.

OBSERVATION & RESULTS

SAMPLE SIZE N = 62

PERCENTAGE ANALYSIS

AGE DISTRIBUTION

AGE DISTRIBUTION	
AGE(YEARS)	**FREQUENCY**
21-40	20
41-60	32
61-80	10

Table 6 Age Distribution

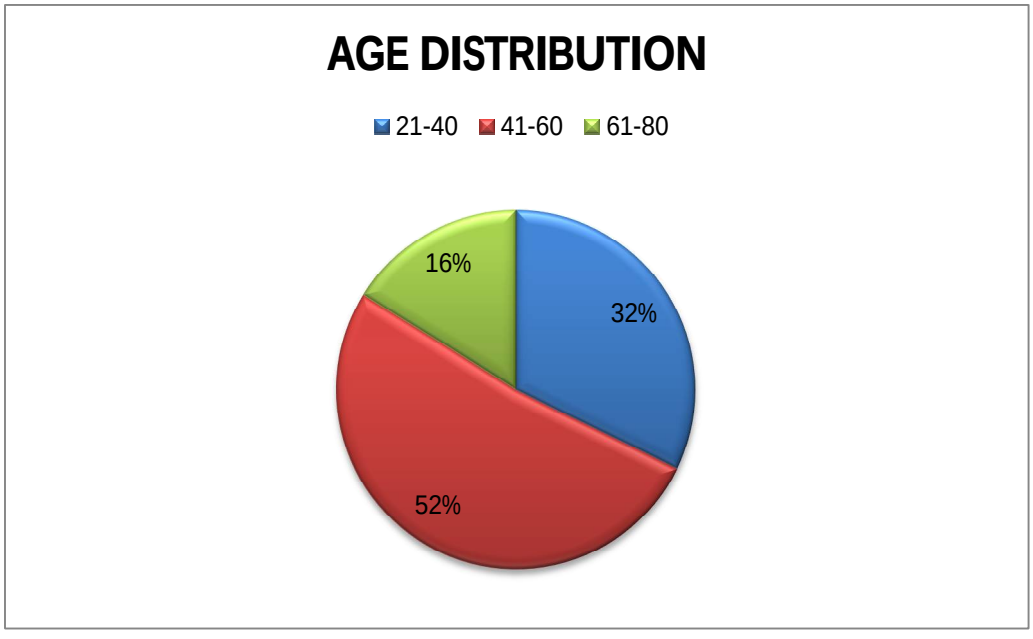

Chart 1 Age Distribution

Majority of study population belongs to 41-60 age group

SEX DISTRIBUTION

SEX DISTRIBUTION	
GENDER	**FREQUENCY**
MALE	35
FEMALE	27

Table 7 Sex Distribution

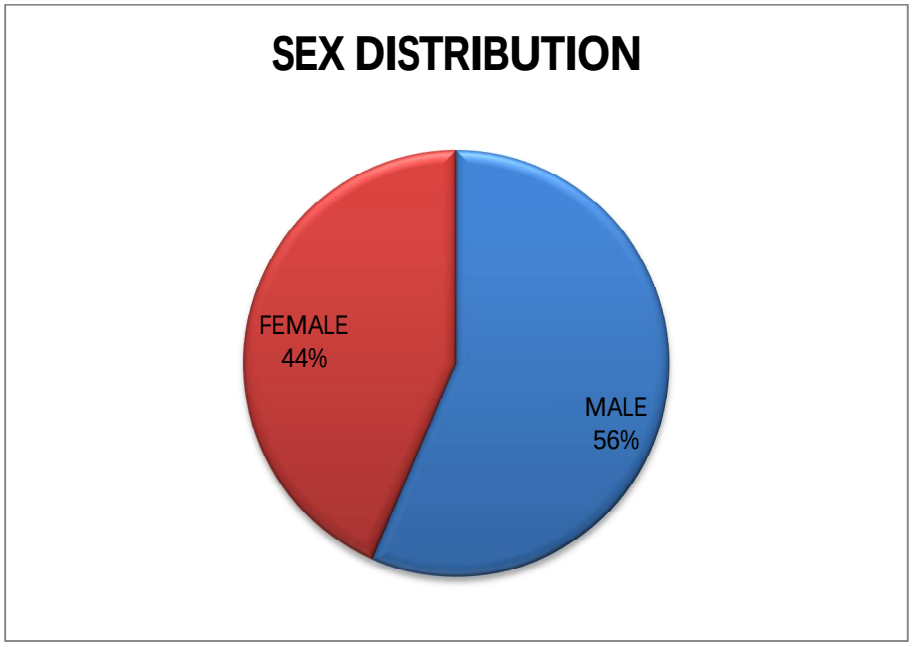

Chart 2 Sex Distribution

56% of study population were males

AGE AND SEX DISTRIBUTION

AGE AND SEX DISTRIBUTION	MALE	FEMALE
21-40	8	12
41-60	23	9
61-80	4	6

Table 8 Age And Sex Distribution

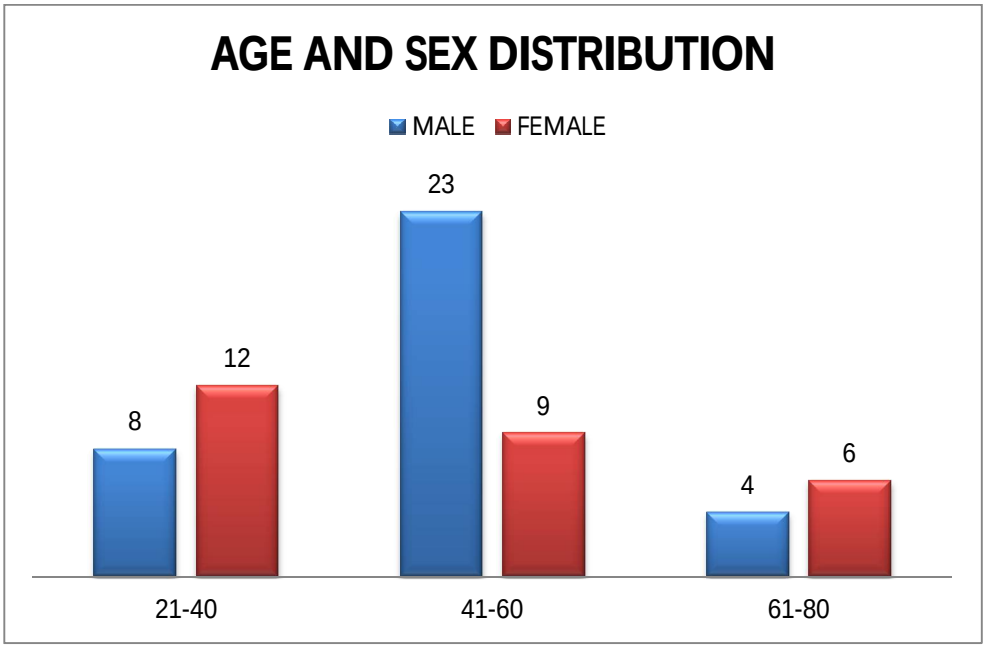

Chart 3 Age And Sex Distribution

TYPE OF PROCEDURE

PROCEDURE	FREQUENCY
EMERGENCY	40
ELECTIVE	22

Table 9 Type of Procedure

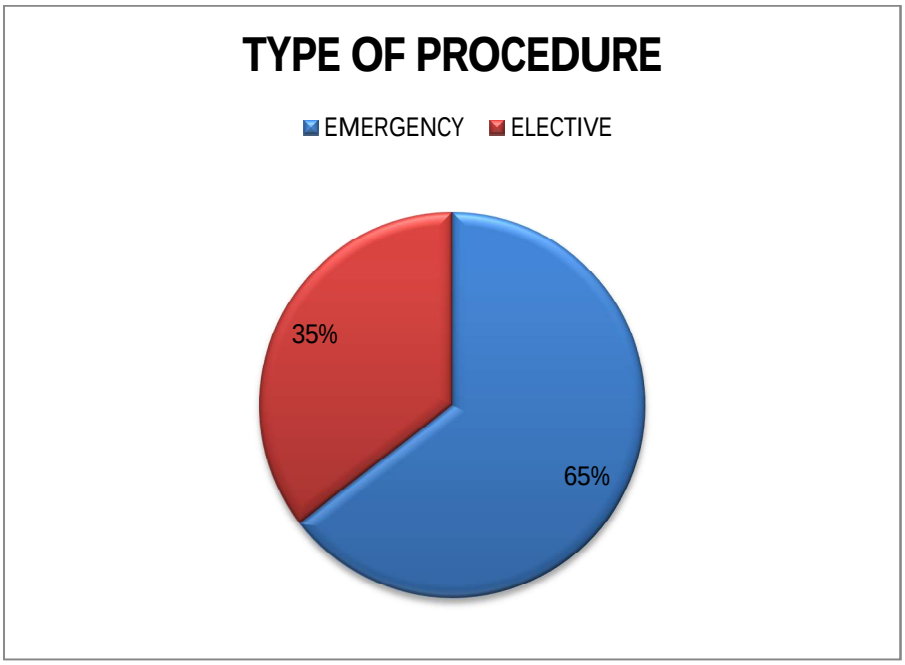

Chart 4 Type of Procedure

BMI DISTRIBUTION

BMI	
UNDERWEIGHT	4
NORMAL	36
OVERWEIGHT	15
OBESE	7

Table 10 BMI distribution

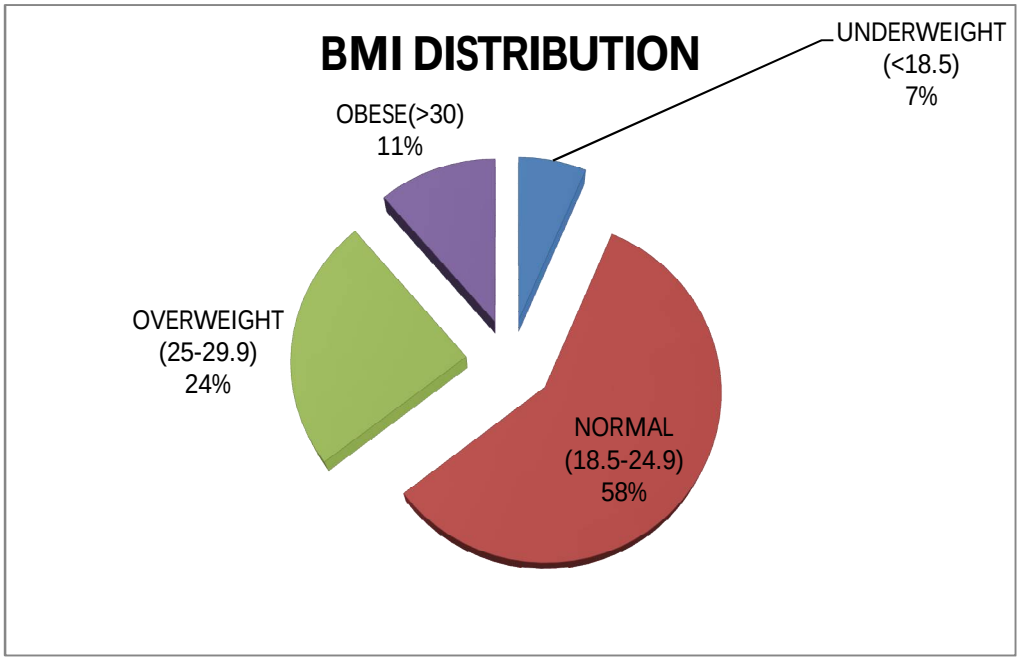

Chart 5 BMI Distribution

Majority (58%) of our study population belong to normal BMI group

DIABETES MELLITUS IN STUDY POPULATION

DIABETIC STATUS	FREQUENCY
DIABETIC	29
NON-DIABETIC	33

Table 11diabetes in study population

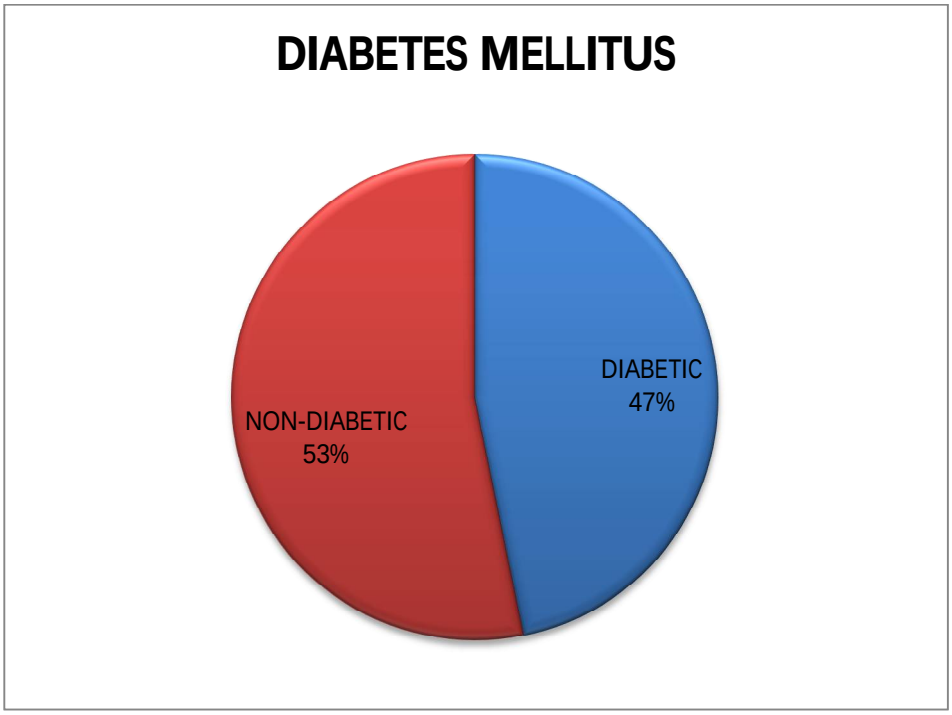

Chart 6 Diabetes in Study Population

Around 47 % of the population under study were found to be diabetic

SMOKING IN STUDY POPULATION

SMOKING	
SMOKER	30
NON-SMOKER	32

Table 12 Smoking In Study Population

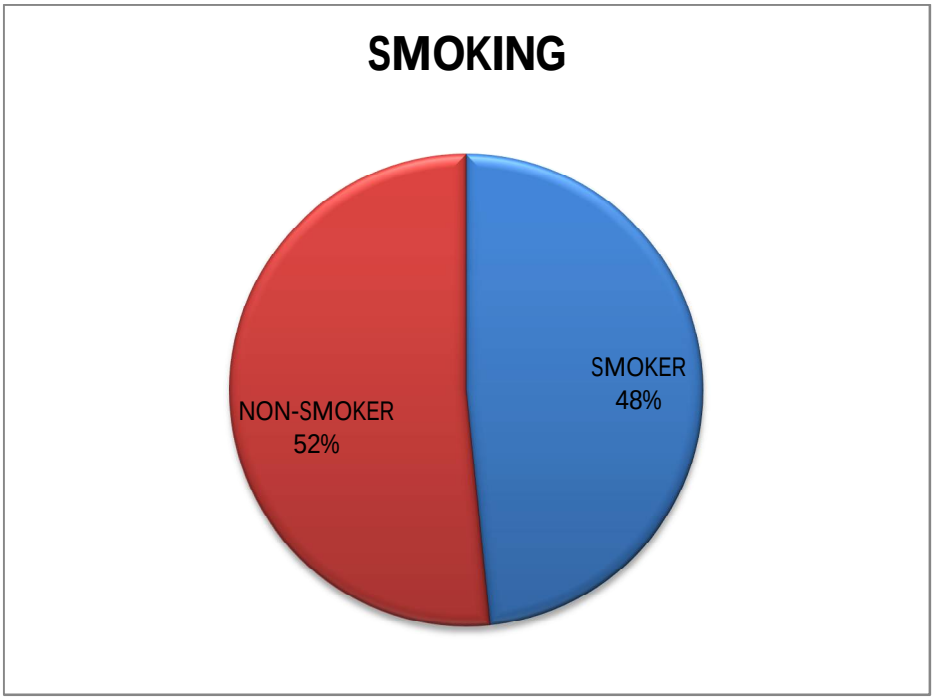

Chart 7 Smoking In Study Population

Around 48 % of the population used to smoke.

ALCOHOLISM AMONG STUDY POPULATION

ALCOHOL CONSUMPTION STATS	FREQUENCY
ALCOHOLIC	28
NOT ALCOHOLIC	34

Table 13 Alcoholism In Study Population

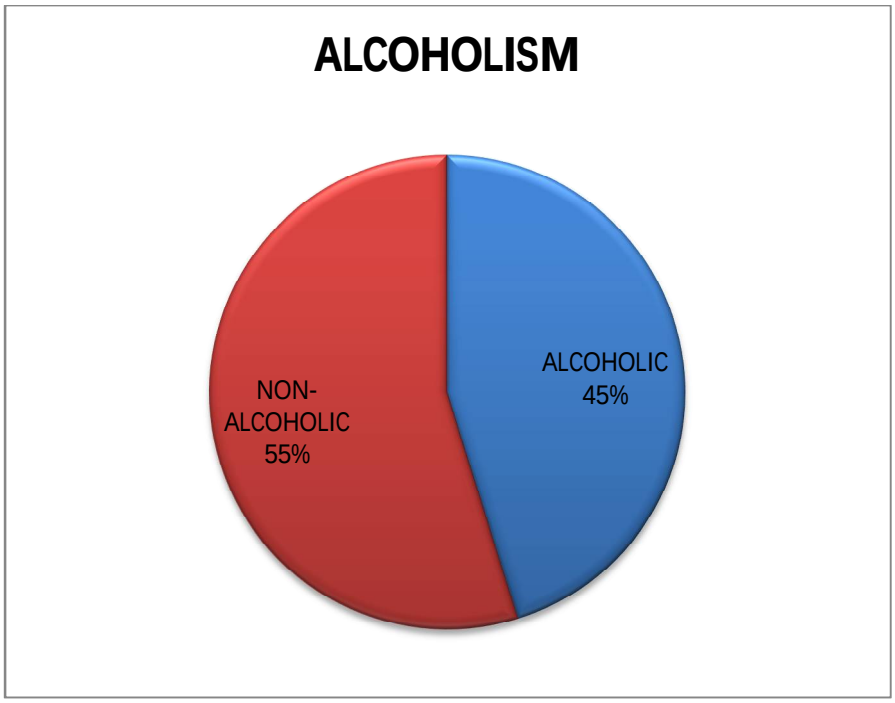

Chart 8 Alcoholism In The Study Population

45 % of the study population was found to consume alcohol

AGE DISTRIBUTION AMONG TWO GROUPS

AGE GROUPS	GROUP 1	GROUP 2	TOTAL
21-40	8	12	20
41-60	17	15	32
61-80	4	6	10
TOTAL	29	33	62

Table 14 Age Distribution Among Group 1 And Group 2

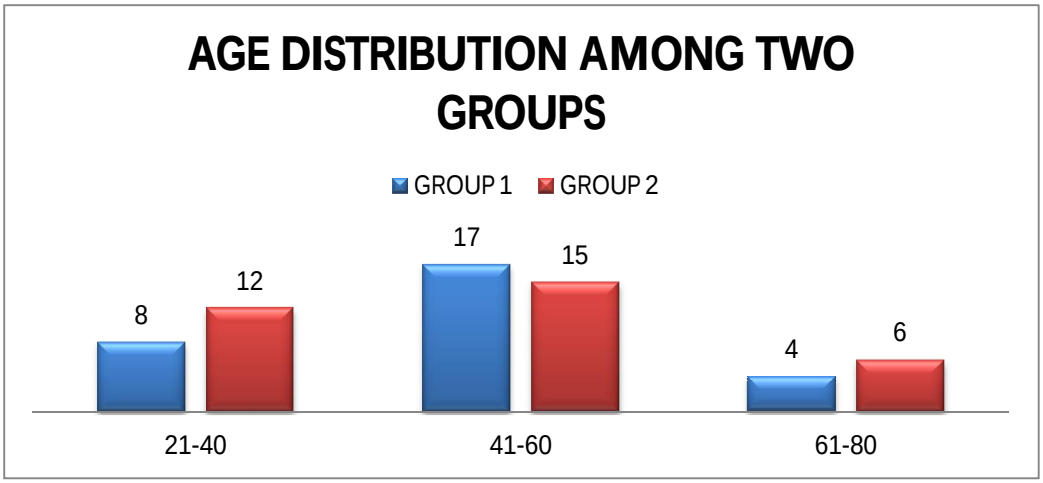

Chart 9 Age Distribution Among Group 1 And Group 2

$X^2 = 1.07(<5.99) P > 0.05$ degree of freedom =2

Hence null hypothesis is accepted.

There is no statistically significant difference in age distribution between Group 1 and Group 2.

Both groups are identical and comparable.

SEX DISTRIBUTION AMONG TWO GROUPS

SEX	GROUP 1	GROUP 2	TOTAL
MALE	15	20	35
FEMALE	14	13	27
TOATAL	29	33	62

Table 15 Sex Distribution Between Group 1 And Group 2

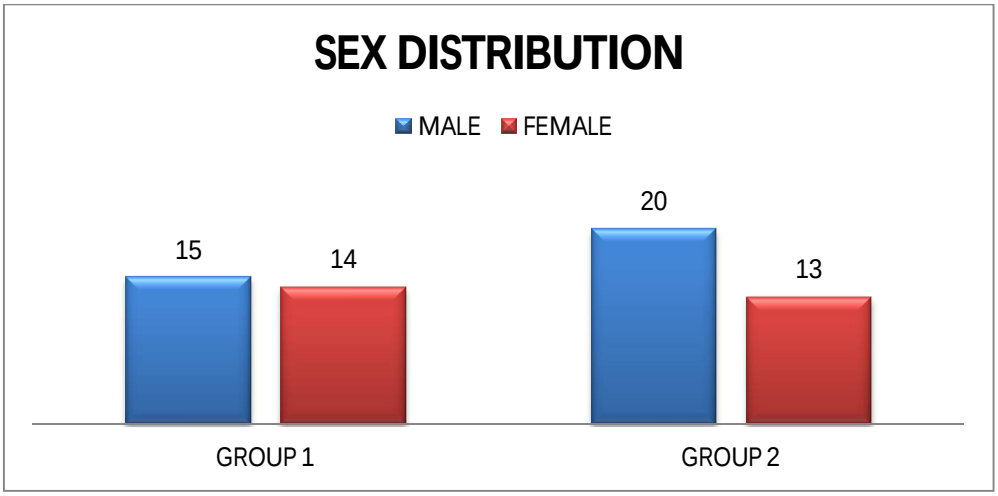

Chart 10 Sex Distribution Between Group 1 And Group 2

X^2= 0.49 (< 3.84) P > 0.05 Degree of freedom = 1

Hence null hypothesis is accepted.

There is no statistically significant difference in sex distribution between group 1 and Group 2

Both groups are identical and comparable.

TYPE OF PROCEDURE

TYPE OF SURGERY	GROUP 1	GROUP 2	TOTAL
EMERGENCY	19	21	40
ELECTIVE	10	12	22
TOTAL	29	33	62

Table 16 Type Of Procedure Among Group 1 And Group 2

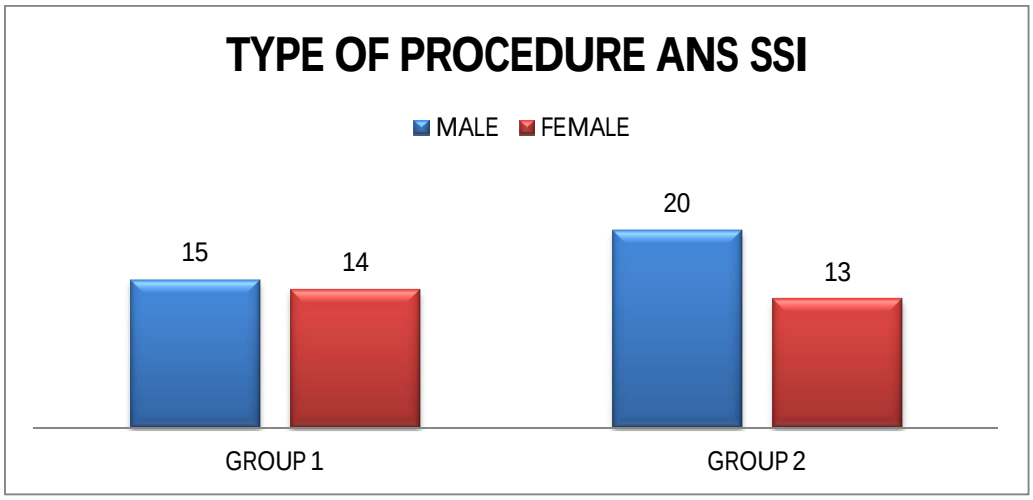

Chart 11 Type Of Procedure Among Group 1 And Group 2

X^2= 0.02 (< 3.84) P > 0.05 Degree of freedom = 1

Hence null hypothesis is accepted.

There is no statistically significant difference in distribution of emergency and elective procedures between two groups.

Both groups are identical and comparable.

SURGICAL SITE INFECTION

SURGICAL SITE INFECTION	FREQUENCY
SSI	17
NO SSI	45

Table 17 Surgical Site Infection In Study Population

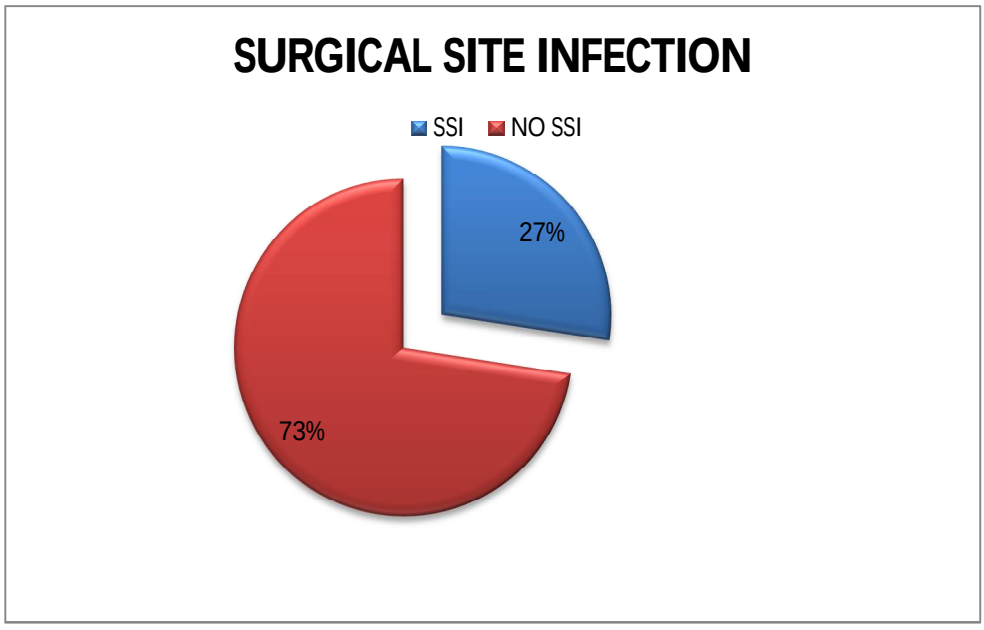

Chart 12 Surgical Site Infection In Study Population

Overall the incidence of SSI was found to be 27 %.

SSI AMONG EMERGENCY AND ELECTIVE PROCEDURES

PROCEDURE	SSI	NO SSI
EMERGENCY	14	26
ELECTIVE	3	19

Table 18 SSI Among Elective And Emergency Procedure

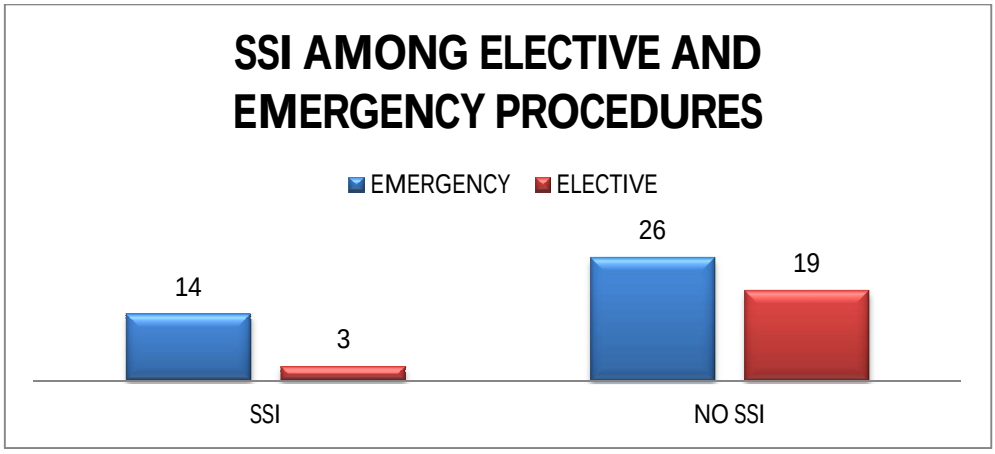

Chart 13 SSI Among Elective And Emergency Procedure

X^2= 10.72(> 7.87) P < 0.05 Degree of freedom = 1

Hence alternate hypothesis is accepted

There is a statistically significant difference in incidence of SSI between elective and emergency procedures.

Relative risk = 2.5. As per our study emergency procedures have more risk of developing SSI.

DIABETES AND SSI

DM	SSI+	SSI-
DM+	12	17
DM-	5	28

Table 19 Diabetes and SSI

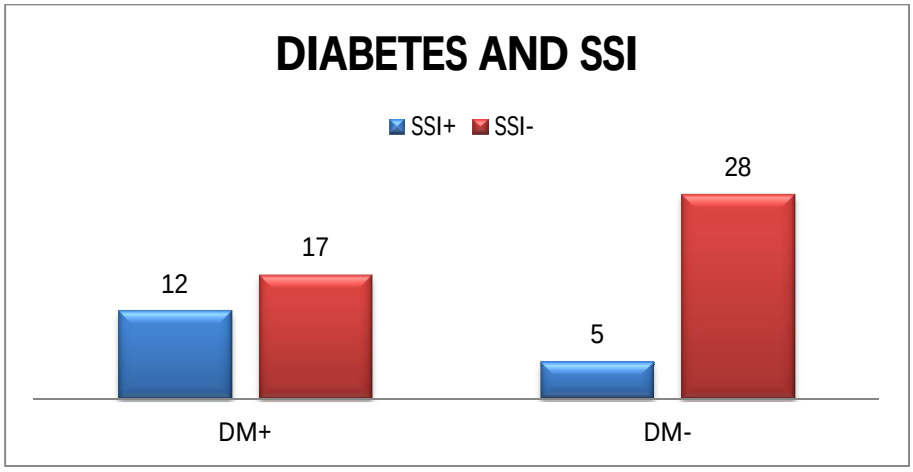

Chart 14 Diabetes and SSI

X^2= 4.63(> 3.84) P > 0.05 Degree of freedom = 1

Hence alternate hypothesis is accepted

There is a statistically significant difference in the incidence of SSI between diabetic and non-diabetic patients.

Relative risk = 68.24

Attributable Risk = 0.58

As per our study diabetes is a risk factor for SSI.

OBESITY AND SSI

OBESITY	SSI +	SSI -
OBESE	4	3
NON OBESE	13	42

Table 20 Obesity and SSI

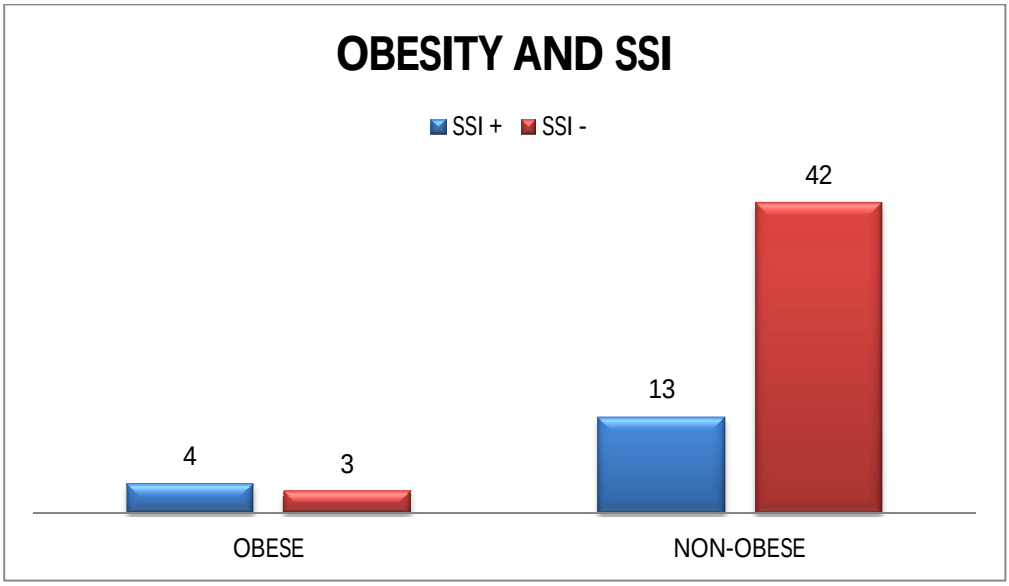

Chart 15 Obesity and SSI

X^2 =1.16 (< 3.84) P > 0.05 Degree of freedom = 1

Hence null hypothesis is accepted.

There is no statistically significant difference in SSI between obese and non-obese patients

Obesity does not influence the chance of devoloping SSI.

ANEMIA AND SSI

ANEMIA	SSI+	SS-
ANEMIA+	8	11
ANEMIA-	9	34

Table 21 Anaemia and SSI

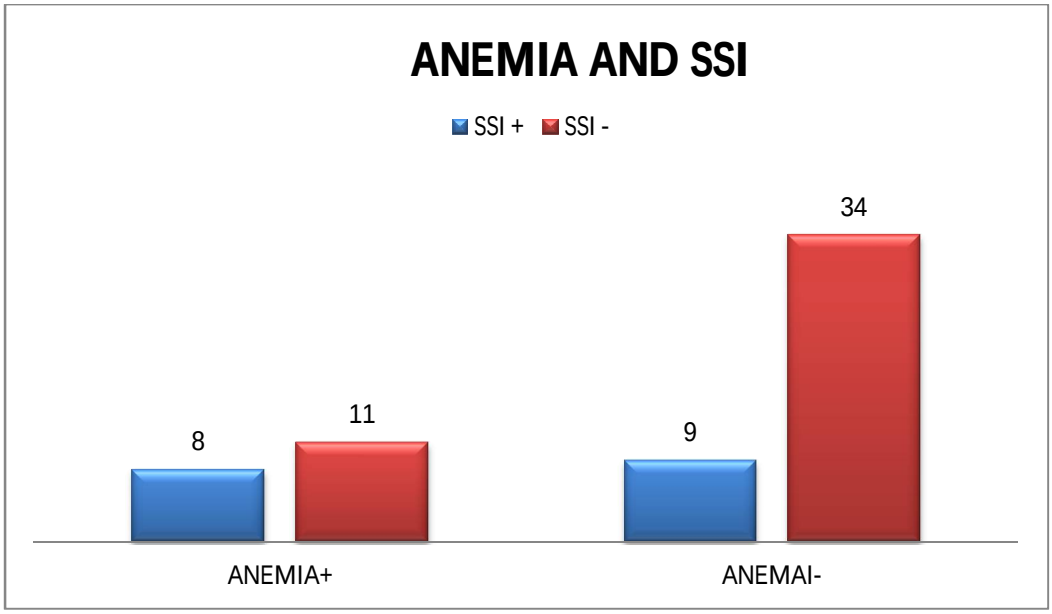

Chart 16 Anemia and SSI

X^2 =2.96 (< 3.84) P > 0.05 Degree of freedom = 1

Hence null hypothesis is accepted

There is no statistically significant difference in SSI between two groups.

Anemia does not influencing the chance of developing SSI.

ALCOHOLISM AND SSI

ALCOHOL USAGE	SSI +	SSI -
ALCOHOLIC	11	17
NON-ALCOHOLIC	6	28

Table 22 Alcoholism and SSI

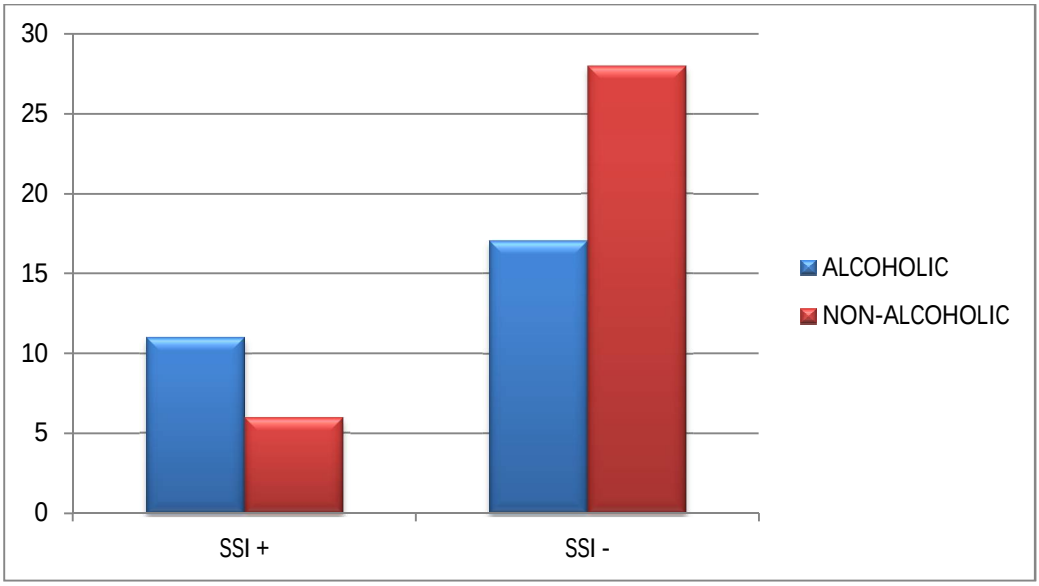

Chart 17 Alcoholism and SSI

X^2 =3.61 (< 3.84) P > 0.05

Hence null hypothesis is accepted

There is no statistically significant difference in SSI between two groups.

Alcohol does not influence the chance of getting SSI.

SMOKING AND SSI

SMOKING	SSI +	SSI -
SMOKER	11	19
NON-SMOKER	6	26

Table 23 Smoking and SSI

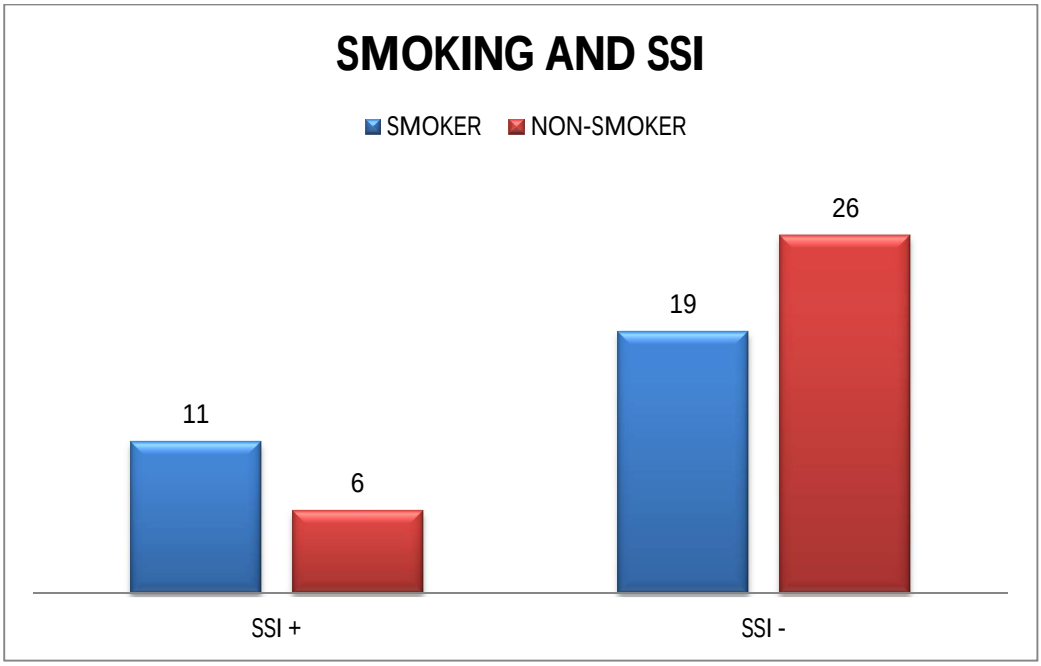

Chart 18 Smoking and SSI

$X^2 = 2.49 (< 3.84)$ $P > 0.05$

Hence null hypothesis is accepted

There is no statistically significant difference in SSI between two groups.

Smoking is ruled out as a co-morbidity SSI.

DURATION OF SURGERY AND SSI

DURATION OF SURGERY	> 3HRS	<3 HRS
SSI +	5	12
SSI -	10	35

Table 24 Duration Of Surgery and SSI

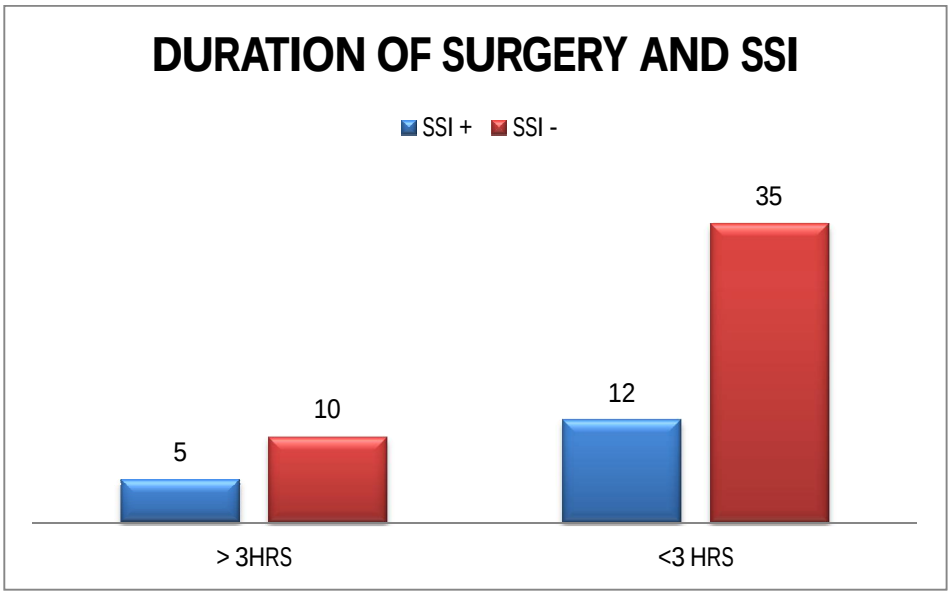

Chart 19 Duration Of Surgery and SSI

$X^2 = 0.3477 (< 3.84)$ $P > 0.05$

Hence null hypothesis is accepted

There is no statistically significant difference in SSI between two groups.

TIME OF ONSET OF SSI

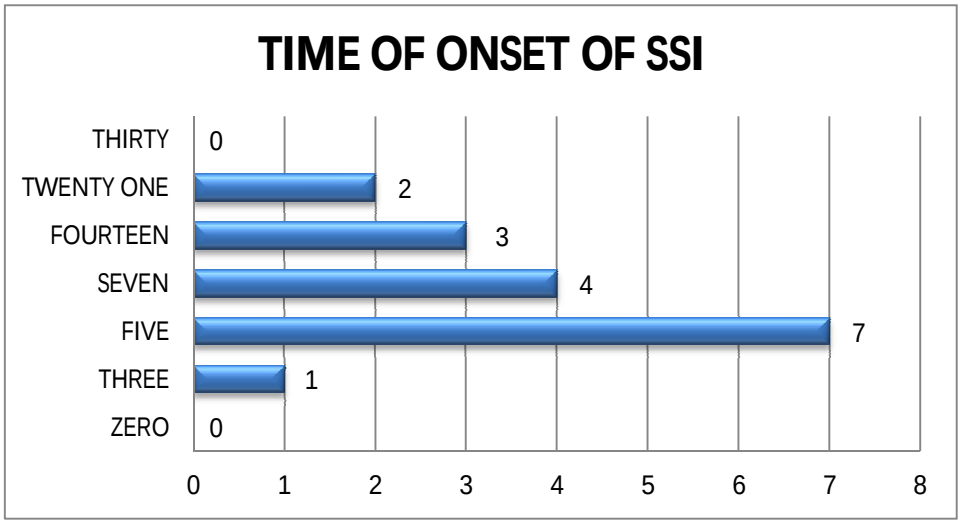

Chart 20 Time of Onset of SSI

SIGNS AND SYMPTOMS OF SSI

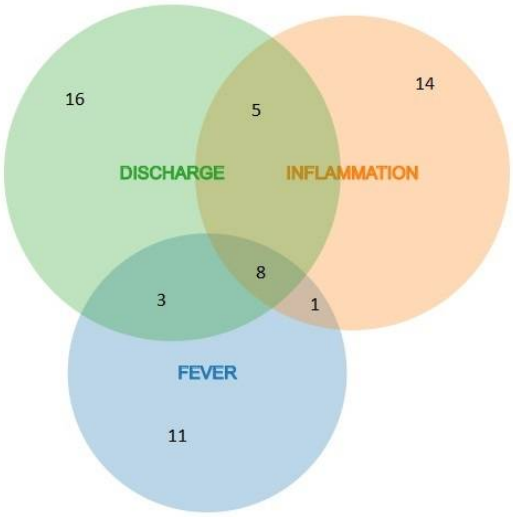

Chart 21 Signs And Symptoms Of SSI

16 patients had discharge from the wound,14 patients developed signs of inflammation and 11 patients had fever.

PROFILES OF PATIENTS WITH AND WITHOUT SSI

PARAMETER	SSI +	SSI -	P
	Mean (SD)	Mean (SD)	
AGE (yrs)	51.24(12.70)	47.44(12.04)	0.2105
BMI(KG/M^2)	24.18(4.46)	23.47(3.46)	0.506
Hb(g/dl)	8.97(2.61)	10.33(2.46)	0.061
TC($\times 10^3$)	13.47(1.50)	8.53(2.06)	0.0001
HOSPITAL STAY (DAYS)	10.35(0.61)	7.16(0.41)	0.0001
RBS(mg/dl)	164.47(73.41)	143.53(61.4)	0.2016

Table 25 Risk Factors for SSI

Total count and hospital stay are found to be extremely statistically significant.

PROFILES OF PATIENTS WITH OR WITHOUT DRAPES

PARAMETER	GROUP 1	GROUP 2	P
	Mean (SD)	Mean (SD)	
AGE (yrs)	48.75(11.89)	48.24(12.72)	0.8716
BMI(KG/M^2)	24.05(3.52)	23.32(3.93)	0.4467
TC($\times 10^3$)	9.91(2.43)	9.89(3.34)	0.9471
Hb(g/dl)	9.89(2.64)	10.04(2.58)	0.822
HOSPITAL STAY (DAYS)	7.8(1.53)	8.21(1.49)	0.29
TIME OF ONSET (DAYS)	7.2(6.1)	7.0(3.97)	0.8775

Table 26 Profiles of Patients Among Group 1 And Group 2

There IS no statistically significant difference in baseline characteristics of two groups.

DRAPES IN NON-DIABETIC PATIENTS

NON-DIABETIC	GROUP 1	GROUP 2
SSI +	0	5
SSI -	16	12

Table 27 Drape in Non-Diabetic Patients

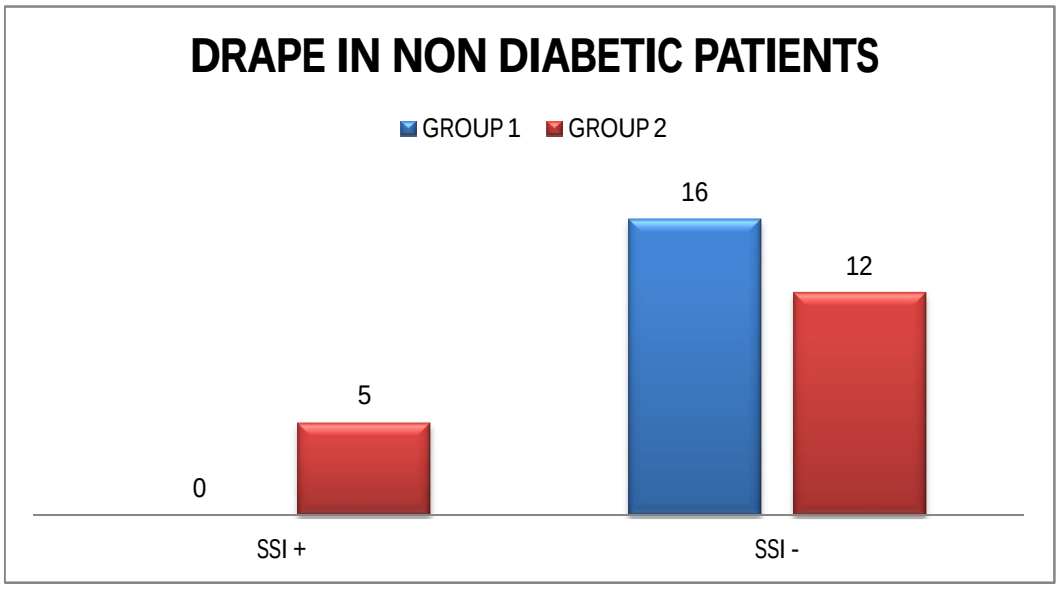

Chart 22 Drape in Non-Diabetic Patients

Fishers exact test value = 0.0444 which is significant at p <0.05

There is a significant difference in the incidence of SSI between two groups among non-diabetics. In non-diabetic patients, using iodine impregnated incise drape reduces the chance of getting surgical site infection.

SSI AMONG GROUP 1 AND GROUP 2

SURGERIES	GROUP 1	GROUP 2
SSI +	7	10
SSI -	22	23

Table 28 SSI among Group 1 and Group 2

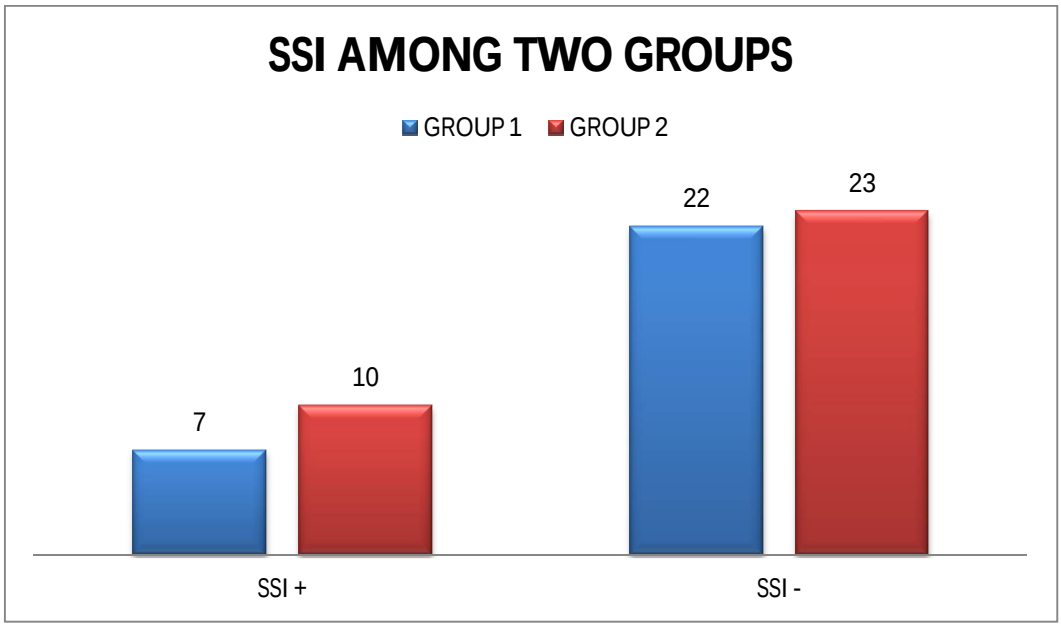

Chart 23 SSI Among Group 1 And Group 2

X^2 =0.2948 (< 3.84) P > 0.05 Degree of freedom = 1

Hence null hypothesis is accepted.

There is no statistically significant difference in the incidence of SSI between Group 1 and Group 2.

The use of drape does not alter the risk of developing SSI

SSI IN EMERGENCY SURGERIES AMONG GROUP 1 AND GROUP 2

EMERGENCY SURGERIES	GROUP 1	GROUP 2
SSI +	6	8
SSI -	13	13

Table 29 SSI in emergency surgeries among Group 1 and Group 2

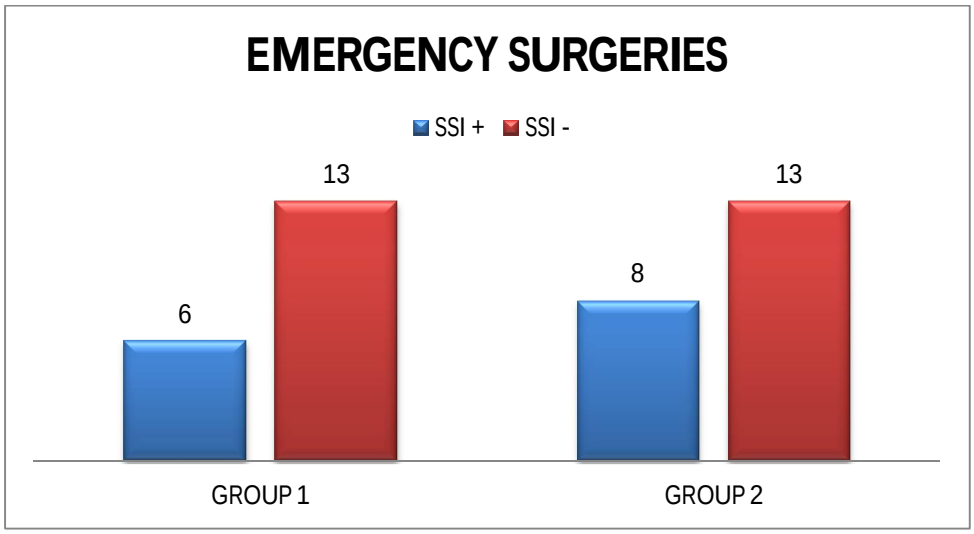

Chart 24 SSI in Emergency Surgeries Among Group 1 And Group 2

X^2 =0.17 (< 3.84) P > 0.05 Degree of freedom = 1

Hence null hypothesis is accepted.

There is no statistically significant difference in incidence of SSI between two groups underwent emergency surgeries

SSI IN ELECTIVE SURGERIES AMONG GROUP 1 AND GROUP 2

ELECTIVE SURGERIES	GROUP 1	GROUP 2
SSI +	1	2
SSI -	9	10

Table 30 SSI in Elective Surgeries Among Group 1 And Group 2

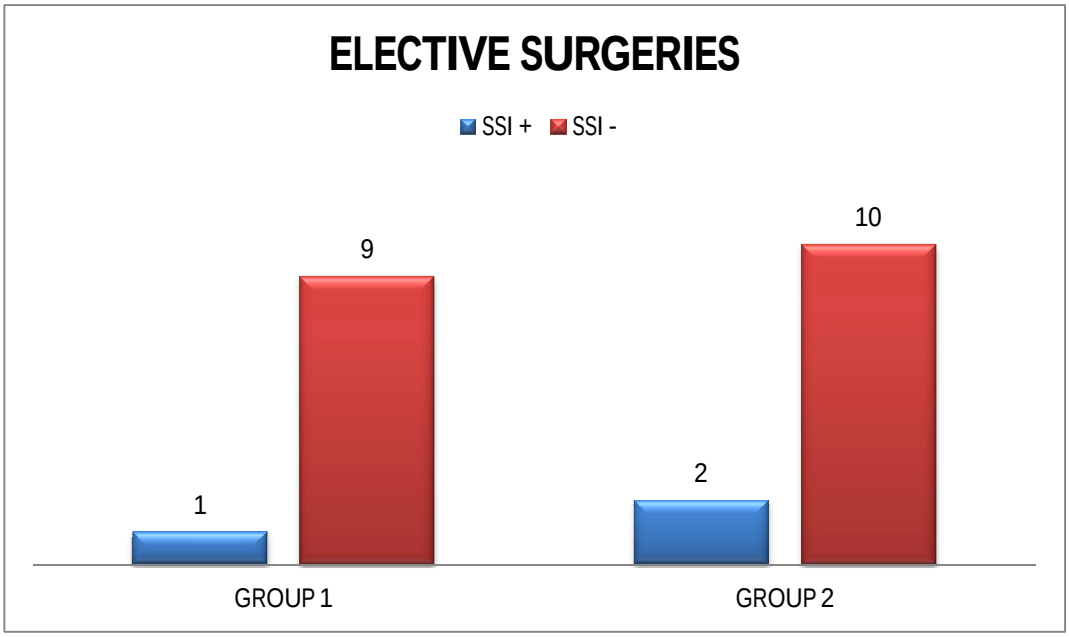

Chart 25 SSI In Elective Surgeries Among Group 1 And Group 2

Fishers exact test value = 0.43 P>0.05

Hence null hypothesis is accepted.

There is no statistically significant difference in incidence of SSI between two groups underwent elective surgerie

DURATION OF SURGERY >3 HOURS

	GROUP 1	GROUP 2
SSI +	0	5
SSI -	6	4

Table 31 Duration Surgery > 3hours And SSI

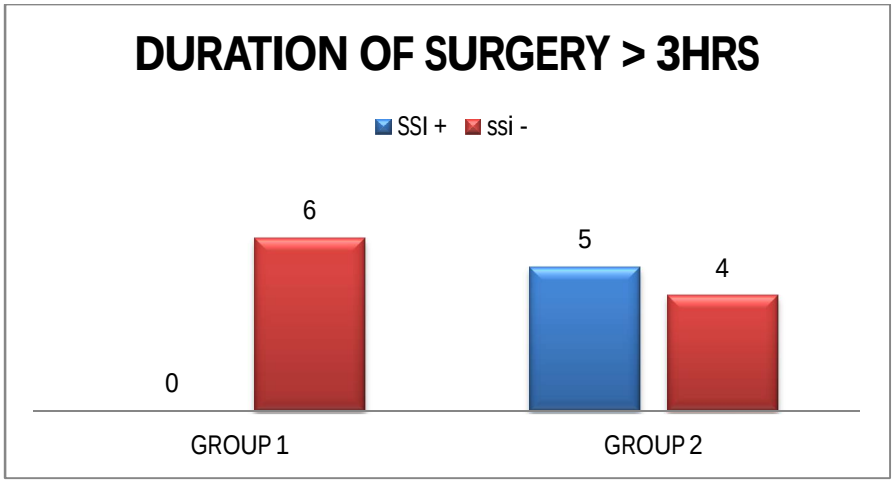

Chart 26 Duration Surgery > 3hours And SSI

Fishers exact test value = 0.0439 P <0.05

Hence alternate hypothesis is accepted.

There is the statistically significant difference in the incidence of SSI between two groups with surgeries more than 3 hours.

For procedures with longer duration, the drape group shows the lesser incidence of surgical site infections.

DURATION OF SURGERY < 3 HOURS

	GROUP 1	GROUP 2
SSI +	7	5
SSI -	16	19

Table 32 Duration Of Surgery < 3 Hrs And SSI

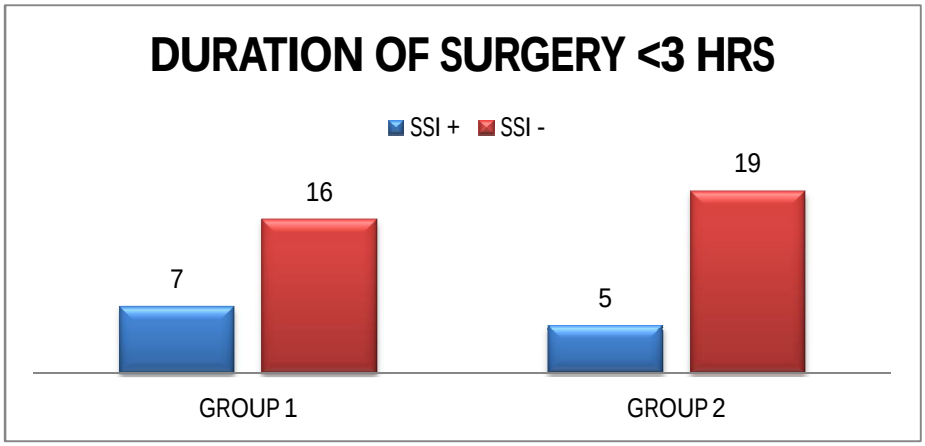

Chart 27 Duration Of Surgery < 3 Hrs and SSI

X^2 =0.5695 (< 3.84) P > 0.05 Degree of freedom = 1

Hence null hypothesis is accepted.

There is no statistically significant difference in the incidence of SSI between two groups in surgeries lasting < 3 hours.

MICROBIOLOGICAL SPECTRUM

E-coli	Proteus Spp.	Klebsiella spp.	S.aureus	Pseudomonas spp.
6	4	3	2	2

Table 33 **Microbiological Spectrum**

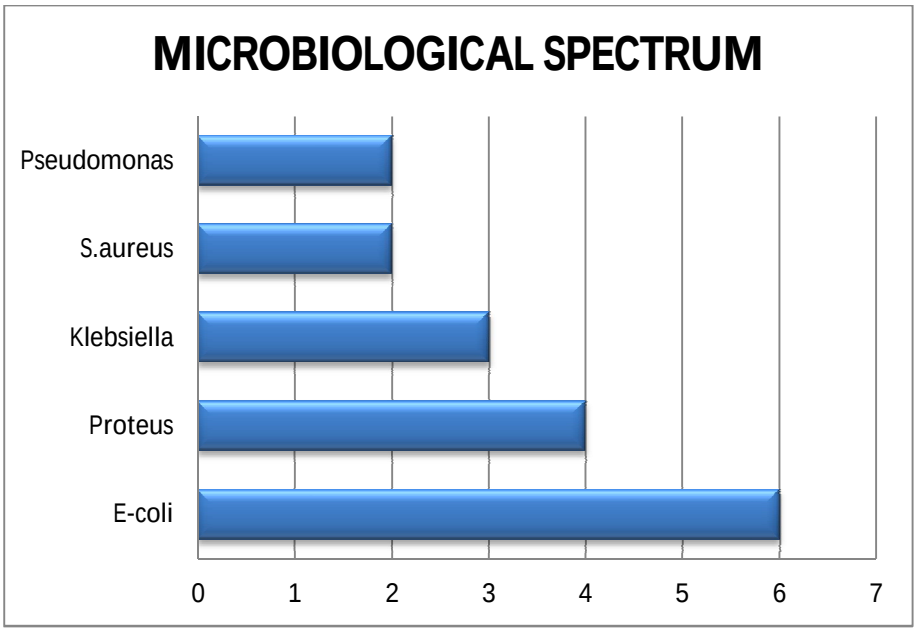

Chart 28 Microbiological spectrum

Most common organism isolated was *Escherichia coli* (35.2%) followed by Proteus mirabilis (23.5%).

DISCUSSION

Plastic adhesive drapes are used in various surgical fields for the past 20 years in an attempt to prevent surgical site infection, by preventing migration of organisms into the open surgical wound. Even though theoretically the use of plastic adhesive incise drapes are arguable, reports have been published regarding their usefulness in limiting bacteria around the surgical site and for preventing SSI are conflicting

A meta-analysis was done by Joan Webster, Abdullah Alghamdi, Centre for Clinical Nursing, Royal Brisbane and Women's Hospital, Brisbane, Australia., shows that a significantly higher proportion of patients developed SSI following use of incising drape[41].

Another study done by Yasuko Yoshimura,1 Shoji Kubo, M.D., Kazuhiro Hirohashi, M.D., Masao Ogawa, M.D., Ken Morimoto, M.D., Kumiko Shirata, Hiroaki Kinoshita, M.D. Osaka City University Graduate School of Medicine[49], shows that iodine impregnated plastic incise drape reduce the chance of SSI.

A study by Dewan et al. shows there is no significant difference in rates of SSI with the use of incising drapes[50].

In our study, in the drape group seven patients develop surgical site infection (incidence 24.13 in 100), and in no drape group, 10 patient developed surgical site infection(30.030 in 100). There is no statistically

significant difference in the incidence of SSI between two groups. But only for surgeries lasting for a longer duration, there was a significant reduction in the incidence of surgical site infection in the drape group. Hence our study does not support the use of iodine impregnated incise drapes as a routine practice for reduction of SSI.

Table 26 compares the baseline profiles of patients with and without drapes and there was no statistically significant difference in profiles between two groups.

Surgical site infections are one of the common post-operative complications and it can occur 22.41% of all clean-contaminated surgeries[2] as per a study conducted by Lilani SP, Jangale N, Chowdhary A, Daver GB on Surgical site infection in clean and clean-contaminated cases published in Indian J Med. In our study, the overall incidence of surgical site infection is around 27%.

Length of the hospital stay was similar in drape group and no drape group. In a similar study conducted by Webster et al, there was no significant reduction in the duration of hospital stay, when the iodine impregnated incise drape was used[51].

The incidence of Surgical Site Infection was more in emergency surgeries(35%) than elective surgeries(13.63%) with a relative risk of 2.5. As per a similar study was done by Manian FA and Mayer L[52] patients

undergoing elective surgery have much less incidence(4%) of surgical site infection than patients undergoing emergency surgery(13%) with a relative risk of 3.6%.

As per a study was done by David E Reichman et al; as the duration of surgery increases, the risk of surgical site infection increases.[52] As per our study surgeries lasting more than 3 hours has an incidence of SSI 33% compared to surgeries lasting for less than 3 hours (incidence 25.5 %). A similar study was done by Varsha Sahane and Saikat Bhawal[53] , Department of Microbiology Dr DY Patil Medical College, Pune ,also shows similar results.

Table 25 compares the profile of patients with and without SSI. It shows elevated total leucocyte count and increased duration of hospital stay in patients who developed surgical site infection.

A study done by Valerian BT, Lee EC, Albany Medical College, New york shows incidence of SSI was higher in diabetic patients(15.4%) than non-diabetic patients(11%). As per this study also diabetes mellitus is a risk factor for developing SSI with a relative risk of 68.24 and attributable Risk = 0.58(Table19). Use of drapes in the non-diabetic population reduces the chance of SSI(Table 27).

As per this study maximum number of cases first developed signs of surgical site infections during the 5th POD (41.17 %).

As per our study surgical site infections with *Escherichia coli* (35.2%) is found to occur in higher frequencies followed by *Proteus mirabilis* (23.5%). As per a similar study was done by David E Reichman et al[54]; gram-negative organisms such as E-coli was found to be the commonest organism causing Surgical Site Infection in cases were hollow viscera was opened during surgery, followed by enterococcus, and anaerobic organisms.

CONCLUSION

Findings from our study do not support the use of iodine impregnated incise drapes as a routine practice in laparotomies for preventing SSI. As the purpose of iodine impregnated incise drape is to prevent skin flora micro-organisms from causing SSI, its use should be limited to clean surgeries and long duration procedures.

The incidence of surgical site infection was found to be higher in emergency surgeries than elective surgeries.

As per our study diabetes mellitus and increased duration of surgery were found to be factors associated with the development of surgical site infection. Efforts should be taken to minimize the duration of surgery without affecting the quality of treatment.

Escherichia coli was found to be the most common organism causing Surgical Site Infection in abdominal surgeries.

Periodic surveillance of Surgical Site Infection will help in formulating strict guidelines, and hence reducing the incidence of Surgical Site Infections.

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PROFORMA

Name	:			
MRD No	:			
Age	:	20 - 40	40 - 60	60 - 80
Sex	:	M	F	
Type of Surgery	:	Emergency		Elective
Length of hospital stay	:			
Risk Factors	:	Diabetes		Smoking
		BMI		Alcohol
Complete blood count	:			
Blood sugar	:			
Renal function test	:			
Liver function test	:			
Duration Of Surgery	:	< 3hr		> 3hr
Procedure Done	:			

- Emergency laparotomy and perfration closure
- Emergency laparotomy and resection and anastomosis
- Feeding Jejunostomy
- Gastrectomy
- Gastrojejunostomy
- Cystogastrostomy
- Emergency laparotomy and Adhesiolysis

Incise Drape : Yes No

Symptomatology of SSI's : Fever

Redness

Pain

Tenderness

Pus discharge

Day of identification of SSI: 3 5 7 14 21 30

Organism Isolated :

CONCENT FORM

I Confirm That I Have Read And Understand The Information Sheet Dated……for the study .

I have had the opportunity to consider the information , ask question & have had this answered satisfactorily .

I understand that my participation is voluntary and that I m free to withdraw at any time, without giving any reason , without my medical care and legal rights being affected .

I understand that relevant sections of any of my medical notes and data collected during study, may be looked at by regulatory authorities , where it is relevant to my talking part in this research. Give permission for these individuals to have assess to my records.

I agree to take part in the above research study.

Name of patient …….

Date ……

Signature/thumb of parent/guardian……

Name of person talking

concent……

Date…….

ஒப்புதல் படிவம்

பெயர் :

வயது :

பாலினம் :

முகவரி:

கோவை அரசு மருத்துவக்கல்லூரி மருத்துவமனையில் மருத்துவர்.; r u j ; M h;v ! ; தலைமையில் நடைபெறும் இந்த ஆய்வில் முழு சம்மதத்துடன் கலந்துகொள்ள சம்மதிக்கிறேன் .இந்த ஆய்வில் என்னை பற்றி விவரங்களை பாதுகாப்புடன் இந்த ஆய்வில் வெளியிட ஆட்சேபணை இல்லை என்று தெரிவித்துக் கொள்கிறேன் .எந்த நேரத்திலும் ஆய்வில் இருந்து எந்த நேரத்திலும் விலக்கிக்கொள்ளும் உரிமை உண்டு என்று அறிவேன் .

இடம் :

தேதி:

கைகெயாப்பம் /ரேகை

KEY FOR MASTER CHART

1	-	Emergency laparotomy and perfration closure
2	-	Emergency laparotomy and resection and anastomosis
3	-	Feeding Jejunostomy
4	-	Gastrectomy
5	-	Gastrojejunostomy
6	-	Cystogastrostomy
7	-	Emergency laparotomy and Adhesiolysis
I	-	Escherichia coIi
II	-	Proteus Mirabilis
III	-	Klebsiella spp.
IV	-	Staphylococcus Aureus
V	-	Pseudomonas spp.

GROUP - 1

SL. NO.	NAME	AGE	SEX	IP NO	PROCEDUR	SMOKING	ALCOHOL	DIABETES	BMI	HB	TC	RBS	S.PROTIEN	S.BILLIRUBIN
1	RAVI	45	M	45079	1	Y	Y	N	26.2	10.9	4900	89	5.9	2.2
2	KARPAGAM	76	F	29895	5	N	N	Y	22.5	6.8	8200	302	4	1.2
3	LALITHA	35	F	44541	1	N	N	N	30	11.2	9000	101	6.8	1.4
4	PERIYASAMI	57	M	51706	1	Y	Y	Y	23.4	13.2	16200	236	4.2	3.4
5	ESWARAN	56	M	72945	6	N	N	N	24.5	13.2	7000	96	7	0.8
6	NAGARAJ	49	M	75954	1	Y	Y	N	27.1	11.9	13400	85	6.8	1
7	MURUGAVEL	56	M	83444	7	Y	N	N	23.4	10.9	8000	103	6.8	1.2
8	ANPBARASAN	48	M	13630	1	Y	Y	N	22.5	9.8	12100	87	4.8	2.6
9	SUMATHI	50	F	47920	1	N	N	Y	25.5	6.9	8800	199	7	1.2
10	TANGAMANI	29	F	51042	1	N	N	Y	21.5	10.2	8900	211	6.8	1.2
11	SAMPOORNAM	62	F	52611	1	N	N	N	17.9	5.9	11900	96	3.8	1.4
12	MEENA	35	F	56216	1	N	N	N	26.3	9.9	7700	110	6.8	1.2
13	KOKILA	39	F	57540	1	N	N	Y	23.2	6.8	8600	209	4	1
14	RAMAMIRTHAM	47	M	83686	6	Y	Y	N	32.1	11.9	9100	108	7.8	0.8
15	MARUTHACHALAM	44	M	15336	1	Y	Y	Y	24.5	14	11100	291	6.6	2.4
16	CHITRA	38	F	67217	1	N	N	N	19.9	9.9	10900	89	6.6	1.8
17	JANAKI	48	F	97862	1	N	N	Y	19.3	10.9	10100	186	7	1.8
18	NAVAMANI	76	F	74017	4	N	N	Y	18.2	6.2	13000	194	4.2	1.6
19	PARIMALA	53	F	72032	1	N	N	N	27.2	11.2	9900	86	6.8	1.2
20	SUBBU	54	M	22887	4	Y	Y	Y	18.9	10.9	9900	203	4.2	2.9
21	GOVITHA RAJ	32	M	28344	1	Y	Y	N	25.6	12.9	6800	95	6.6	1
22	VANITHAMANI	50	F	318	4	N	N	N	23.2	6.5	7900	95	3.9	1
23	BHAGYALAKSHMI	63	F	335	1	N	N	Y	21.1	5.9	13100	144	3.5	0.6
24	INDRANI	55	F	10871	3	N	N	N	26.2	6	8600	104	3.6	0.8
25	PARAMASIVAM	56	M	39689	3	Y	Y	Y	23.3	6.2	9400	139	5	1.8
26	MUMOORTHY	48	M	94611	1	Y	Y	N	30.2	10.3	9100	96	6.7	1.6
27	RAJU	45	M	91945	6	Y	Y	N	27	10.9	9000	96	6.6	1.6
28	LOKANATHAN	30	M	91637	1	Y	N	N	24.2	13.2	13100	103	7.8	0.8
29	ABDULRAHMAN	38	M	91796	1	Y	Y	Y	22.9	12.4	12100	204	7.9	2.9

GROUP - 2

30	MUTHUKUMAR	32	M	35857	1	Y	Y	N	26.8	13.6	14100	126	7.9	0.8
31	JOHN JOSEPH	26	M	37724	1	Y	Y	N	21.7	14.6	3100	103	8.1	1.4
32	AYYAPAN	55	M	43980	5	Y	Y	Y	20.2	14.2	9100	149	8	2.6
33	SHAHIRSHA	33	F	72934	1	N	N	N	20.8	6.9	17000	121	4.9	0.6
34	ARUMUGAM	59	M	43883	5	Y	Y	Y	20.9	6.9	9300	196	4.9	1.6
35	MARIMUTHU	52	M	55298	7	Y	Y	N	19.8	11.1	9100	98	6.9	2.1
36	SHAJAHAN	50	M	52403	7	Y	Y	N	28.8	11.2	11100	111	6.4	1.4
37	GOPINATH	53	M	84791	1	Y	Y	N	20	10	4700	109	6.2	1.4
38	VISHWANATHAN	68	M	81141	2	Y	Y	Y	22.1	6.9	14000	301	5	2.1
39	KRISHNAVENI	44	F	60896	1	N	N	N	31.2	9.6	13600	84	6	1
40	SIVARANJINI	39	F	16788	1	N	N	N	25.9	6.8	4600	79	4.8	0.8
41	LATHA	43	F	22282	1	N	N	N	22	10.4	7400	96	6.8	0.8
42	PANJAVARNAM	42	F	29203	2	N	N	Y	22	6.9	13900	311	4.9	2
43	BHARATHI	38	F	29293	1	N	N	N	20	6.9	6000	109	6.4	1.2
44	THAMBURAN	43	M	10579	5	Y	Y	Y	21.6	10.8	14000	199	7	2.1
45	RAVICHANDRAMOHAN	46	M	17633	1	N	N	N	26.9	13.2	8100	120	7.5	1.2
46	SHANMUGAM	72	M	30173	3	Y	Y	Y	22	11.2	7100	209	6.9	1.8
47	PARTHIBAN	38	M	30217	1	Y	Y	N	22.2	11.2	9100	76	6.9	2.9
48	KUMAR	53	M	40248	1	Y	Y	N	27.6	10.8	13400	99	6.6	1.2
49	KARHI	38	M	56631	1	N	N	Y	23	12.8	7400	156	7	0.8
50	MURUGAVEL	76	M	38434	3	N	N	Y	18.3	6.2	8950	210	5	1.6
51	MAHENDRAN	50	M	40296	6	Y	Y	Y	19.9	12	6400	222	6	2.6
52	DHANUSHKODI	56	M	49884	1	Y	Y	N	26.7	13.1	10000	121	6.5	1.6
53	MUMTHAJ	38	F	30852	1	N	N	Y	30.4	6.3	14900	202	6.5	1.2
54	PADMAVATHI	39	F	42688	7	N	N	N	20.2	9.9	9800	109	6.4	1.2
55	KALIYAMMAL	69	F	48548	2	N	N	Y	21.2	6.7	11200	139	6.7	1
56	GANASHAMOORTHY	70	M	41389	3	N	N	Y	18	10.1	8400	301	6.8	0.8
57	SIDHARTHAN	38	M	34284	1	Y	Y	N	30.2	12.1	12200	98	6.7	2.6
58	KANAKALAKSHMI	39	F	42902	1	N	N	N	20.2	9.7	11000	76	6	0.8
59	NACHIYAPPAN	46	M	40177	1	Y	Y	Y	21.3	11.1	7200	132	6.4	1.6
60	BHAGYAM	50	F	50556	5	N	N	Y	31.1	10.2	13000	196	6.2	1
61	VASANTHA	62	F	51149	3	N	N	N	20.2	6.8	8000	96	5.8	1
62	DEVI	35	F	55928	1	N	N	Y	26.6	10.4	9000	209	6.2	0.8

								DAY OF IDENTIFICATION OF SSI						
SL. NO.	B.UREA	S.CREATINI	DURATION	HOSPITAL S	SIGNS OF II	FEVER	DISCHARGE	3	5	7	14	21	30	MICROBIOLOGY
1	23	0.7	90	7	N	N	N	.	.	.	.	.	.	.
2	22	0.9	100	8	N	N	N	.	.	.	.	.	.	.
3	20	0.8	110	8	N	N	N	.	.	.	.	.	.	.
4	24	0.9	190	11	Y	Y	Y	.	Y	.	.	.	.	I
5	23	0.4	80	7	N	N	N	.	.	.	.	.	.	.
6	20	0.6	100	10	N	Y	Y	.	.	Y	.	.	.	II
7	19	0.9	90	7	N	N	N	.	.	.	.	.	.	.
8	20	0.8	100	10	Y	Y	Y	.	Y	.	.	.	.	I
9	33	1.2	110	7	N	N	N	.	.	.	.	.	.	.
10	32	0.9	220	8	N	N	N	.	.	.	.	.	.	.
11	24	1.3	110	10	Y	Y	Y	.	Y	.	.	.	.	III
12	29	0.9	120	7	N	N	N	.	.	.	.	.	.	.
13	20	0.9	90	7	N	N	N	.	.	.	.	.	.	.
14	19	0.9	190	8	N	N	N	.	.	.	.	.	.	.
15	21	1	200	8	N	N	N	.	.	.	.	.	.	.
16	31	1.1	70	7	N	N	N	.	.	.	.	.	.	.
17	30	0.8	90	8	N	N	N	.	.	.	.	.	.	.
18	28	0.8	100	11	N	Y	Y	Y	.	.	.	.	.	V
19	29	0.9	200	7	N	N	N	.	.	.	.	.	.	.
20	29	0.8	110	8	N	N	N	.	.	.	.	.	.	.
21	23	0.9	70	7	N	N	N	.	.	.	.	.	.	.
22	24	1.2	90	7	N	N	N	.	.	.	.	.	.	.
23	20	0.9	100	10	Y	Y	Y	.	Y	.	.	.	.	IV
24	19	1.1	70	8	N	N	N	.	.	.	.	.	.	.
25	30	0.9	210	8	N	N	N	.	.	.	.	.	.	.
26	18	0.8	60	8	N	N	N	.	.	.	.	.	.	.
27	19	0.8	80	8	N	N	N	.	.	.	.	.	.	.
28	32	0.7	90	8	N	N	N	.	.	.	.	.	.	.
29	36	1	110	11	Y	N	Y	.	.	.	Y	.	.	I

								DAY OF IDENTIFICATION OF SSI						
30	38	0.8	90	8	N	N	N	.	.	.	.	.	.	.
31	35	1	100	8	N	N	N	.	.	.	.	.	.	.
32	34	1.1	90	7	N	N	N	.	.	.	.	.	.	.
33	33	1.1	200	11	Y	N	Y	.	Y	.	.	.	.	II
34	33	1.1	100	8	N	N	N	.	.	.	.	.	.	.
35	32	0.7	110	7	N	N	N	.	.	.	.	.	.	.
36	28	1.1	120	8	N	N	N	.	.	.	.	.	.	.
37	19	0.8	180	8	N	N	N	.	.	.	.	.	.	.
38	20	1	90	10	Y	Y	Y	Y	.	.	.	.	.	II
39	27	0.9	70	10	Y	N	N	.	Y	.	.	.	.	I
40	26	0.9	110	8	N	N	N		.	.	.	.	.	.
41	28	1	130	7	N	N	N	.	.	.	.	.	.	.
42	29	1.1	200	11	Y	Y	Y	.	Y	.	.	.	.	III
43	31	1.3	130	8	N	N	N	.	.	.	.	.	.	.
44	30	1.2	140	10	Y	N	Y	Y	.	.	.	.	.	IV
45	29	1.1	210	8	N	N	N	.	.	.	.	.	.	.
46	29	0.9	90	8	N	N	N	.	.	.	.	.	.	.
47	30	0.8	150	7	N	N	N	.	.	.	.	.	.	.
48	38	0.9	200	11	Y	Y	Y	.	.	Y	.	.	.	V
49	36	0.4	90	7	N	N	N	.	.	.	.	.	.	.
50	38	1.1	100	8	N	N	N	.	.	.	.	.	.	.
51	39	1	150	8	N	N	N	.	.	.	.	.	.	.
52	19	0.9	110	8	N	N	N	.	.	.	.	.	.	.
53	21	1.1	70	12	Y	N	Y	.	.	Y	.	.	.	I
54	23	1.1	100	7	N	N	N	.	.	.	.	.	.	.
55	24	1.1	120	11	N	Y	Y	.	.	Y	.	.	.	III
56	29	0.7	100	8	N	N	N	.	.	.	.	.	.	.
57	33	0.9	190	10	Y	N	Y	.	.	.	Y	.	.	II
58	30	0.9	210	8	N	N	N	.	.	.	.	.	.	.
59	31	1.1	100	8	N	N	N	.	.	.	.	.	.	.
60	34	1.6	70	10	Y	Y	Y	.	.	.	Y	.	.	I
61	34	1.1	210	7	N	N	N	.	.	.	.	.	.	.
62	29	1.6	90	8	N	N	N	.	.	.	.	.	.	.